FIG.1

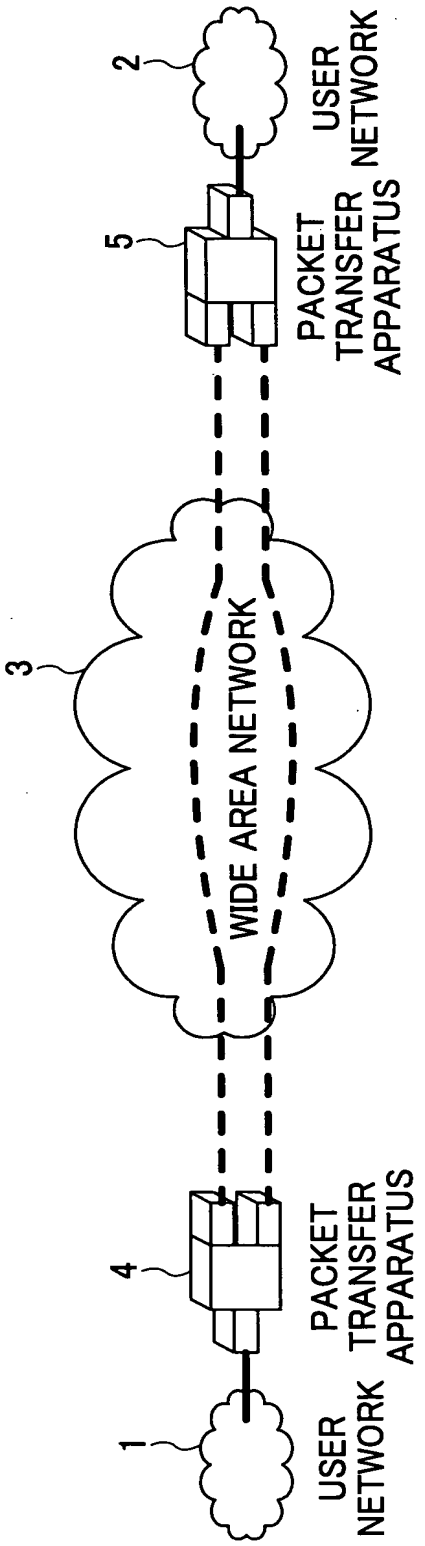

2
USER NETWORK
5
PACKET TRANSFER APPARATUS
3
WIDE AREA NETWORK
4
PACKET TRANSFER APPARATUS
1
USER NETWORK

FIG.2

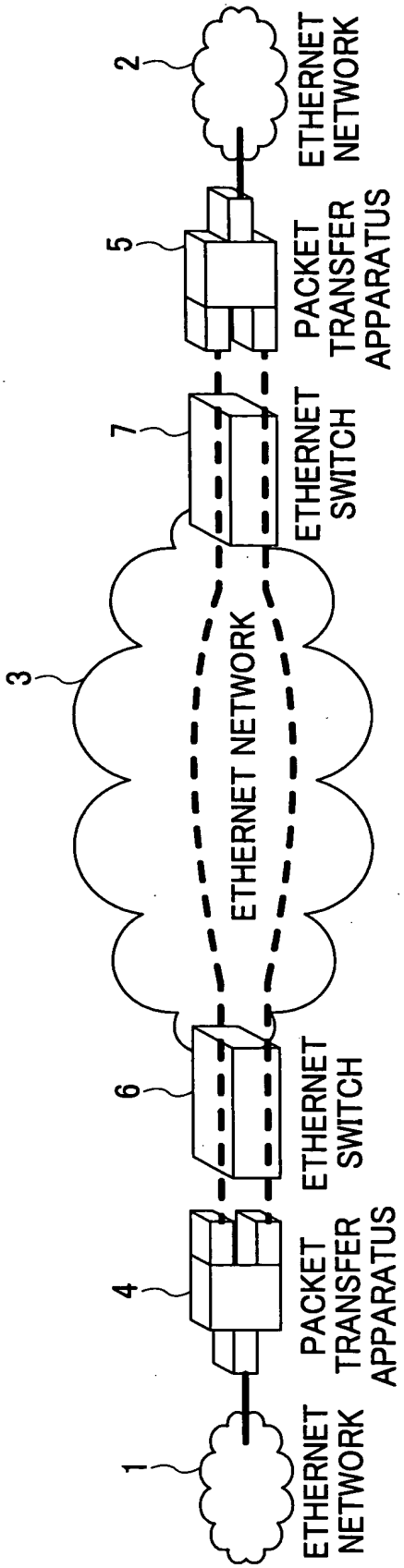
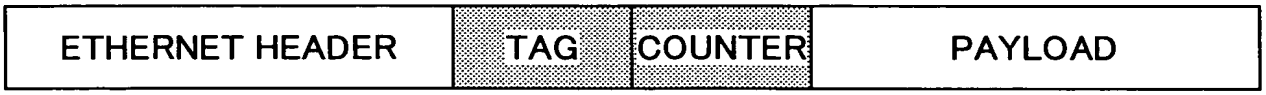

1
ETHERNET NETWORK
4
PACKET TRANSFER APPARATUS
6
ETHERNET SWITCH
3
ETHERNET NETWORK
7
ETHERNET SWITCH
5
PACKET TRANSFER APPARATUS
2
ETHERNET NETWORK

FIG.3



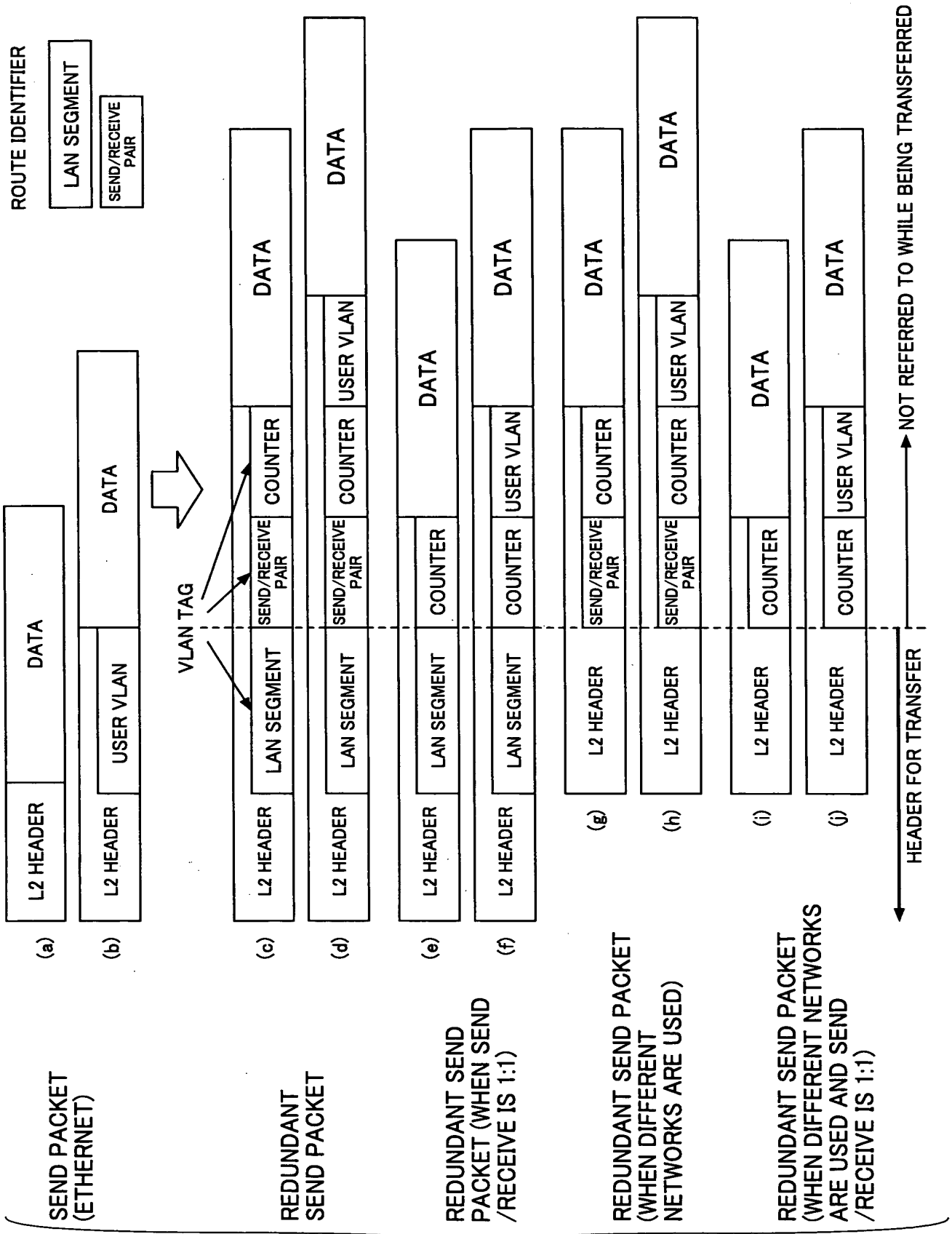

ROUTE IDENTIFIER
LAN SEGMENT
SEND/RECEIVE PAIR
SEND PACKET (ETHERNET)
REDUNDANT SEND PACKET
REDUNDANT SEND PACKET (WHEN SEND /RECEIVE IS 1:1)
REDUNDANT SEND PACKET (WHEN DIFFERENT NETWORKS ARE USED)
REDUNDANT SEND PACKET (WHEN DIFFERENT NETWORKS ARE USED AND SEND /RECEIVE IS 1:1)
(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
(i)
(j)
L2 HEADER
DATA
USER VLAN
VLAN TAG
SEND/RECEIVE PAIR
COUNTER
LAN SEGMENT
HEADER FOR TRANSFER
NOT REFERRED TO WHILE BEING TRANSFERRED

FIG.4

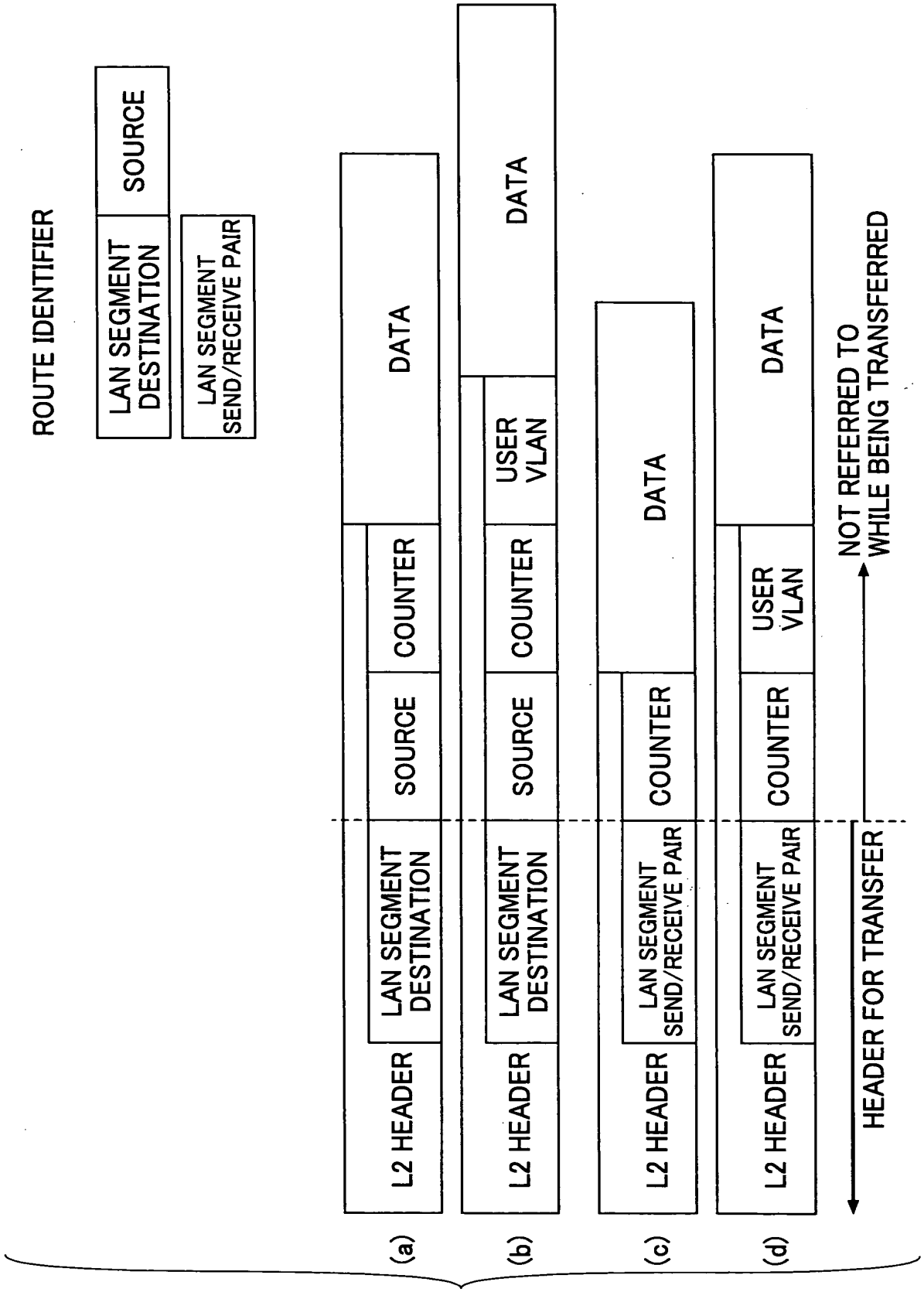

ROUTE IDENTIFIER
SOURCE
LAN SEGMENT DESTINATION
LAN SEGMENT SEND/RECEIVE PAIR
(a)
L2 HEADER
LAN SEGMENT DESTINATION
SOURCE
COUNTER
DATA
(b)
L2 HEADER
LAN SEGMENT DESTINATION
SOURCE
COUNTER
USER VLAN
DATA
(c)
L2 HEADER
LAN SEGMENT SEND/RECEIVE PAIR
COUNTER
DATA
(d)
L2 HEADER
LAN SEGMENT SEND/RECEIVE PAIR
COUNTER
USER VLAN
DATA
HEADER FOR TRANSFER
NOT REFERRED TO WHILE BEING TRANSFERRED

FIG.5

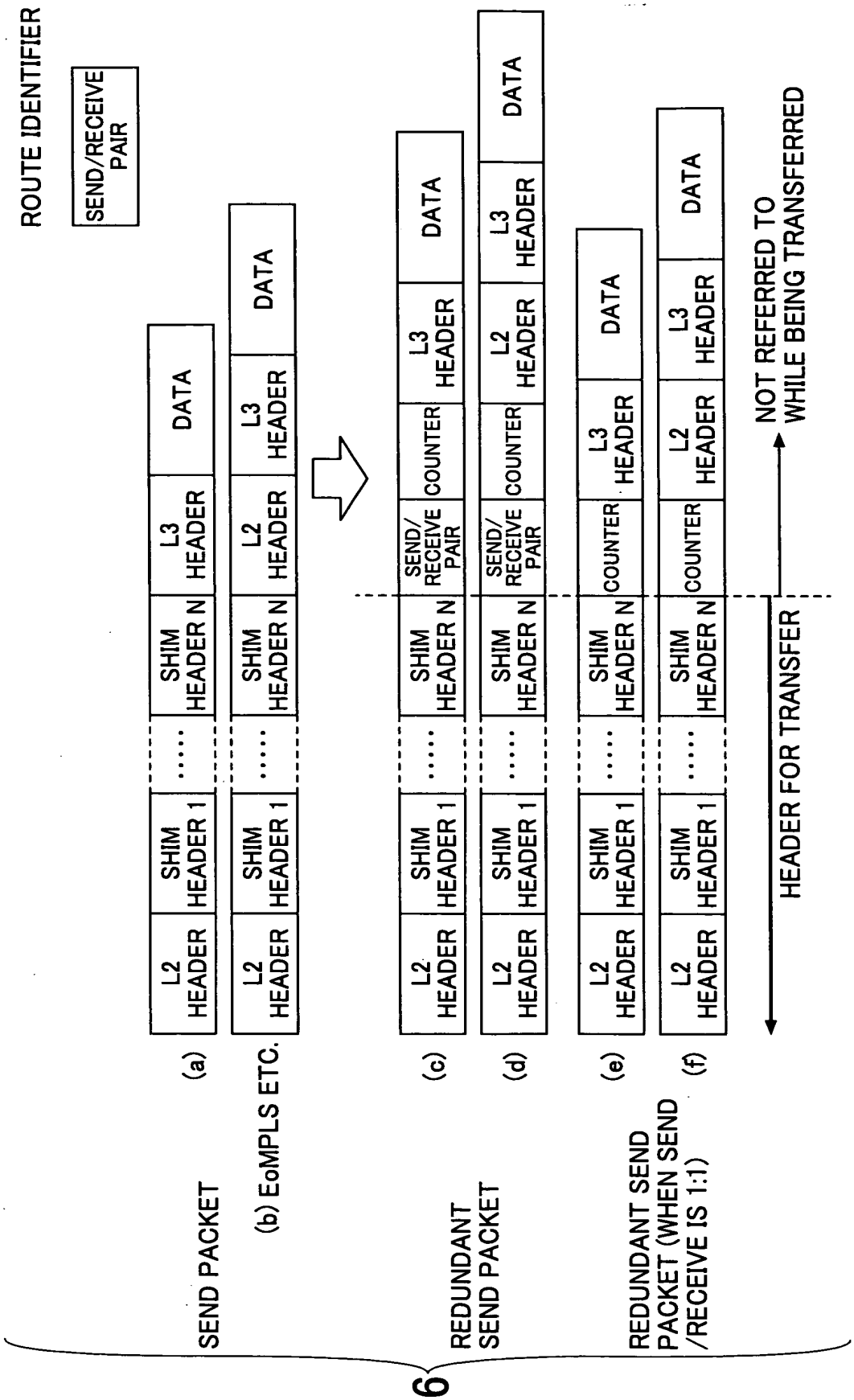

ROUTE IDENTIFIER
SEND/RECEIVE PAIR
L2 HEADER
SHIM HEADER 1
.....
SHIM HEADER N
L3 HEADER
DATA
L2 HEADER
SHIM HEADER 1
.....
SHIM HEADER N
L2 HEADER
L3 HEADER
DATA
(a)
(b) EoMPLS ETC.
SEND PACKET
L2 HEADER
SHIM HEADER 1
.....
SHIM HEADER N
SEND/ RECEIVE PAIR
COUNTER
L3 HEADER
DATA
(c)
L2 HEADER
SHIM HEADER 1
.....
SHIM HEADER N
SEND/ RECEIVE PAIR
COUNTER
L2 HEADER
L3 HEADER
DATA
(d)
REDUNDANT SEND PACKET
L2 HEADER
SHIM HEADER 1
.....
SHIM HEADER N
COUNTER
L3 HEADER
DATA
(e)
L2 HEADER
SHIM HEADER 1
.....
SHIM HEADER N
COUNTER
L2 HEADER
L3 HEADER
DATA
(f)
REDUNDANT SEND PACKET (WHEN SEND /RECEIVE IS 1:1)
NOT REFERRED TO WHILE BEING TRANSFERRED
HEADER FOR TRANSFER

FIG.6

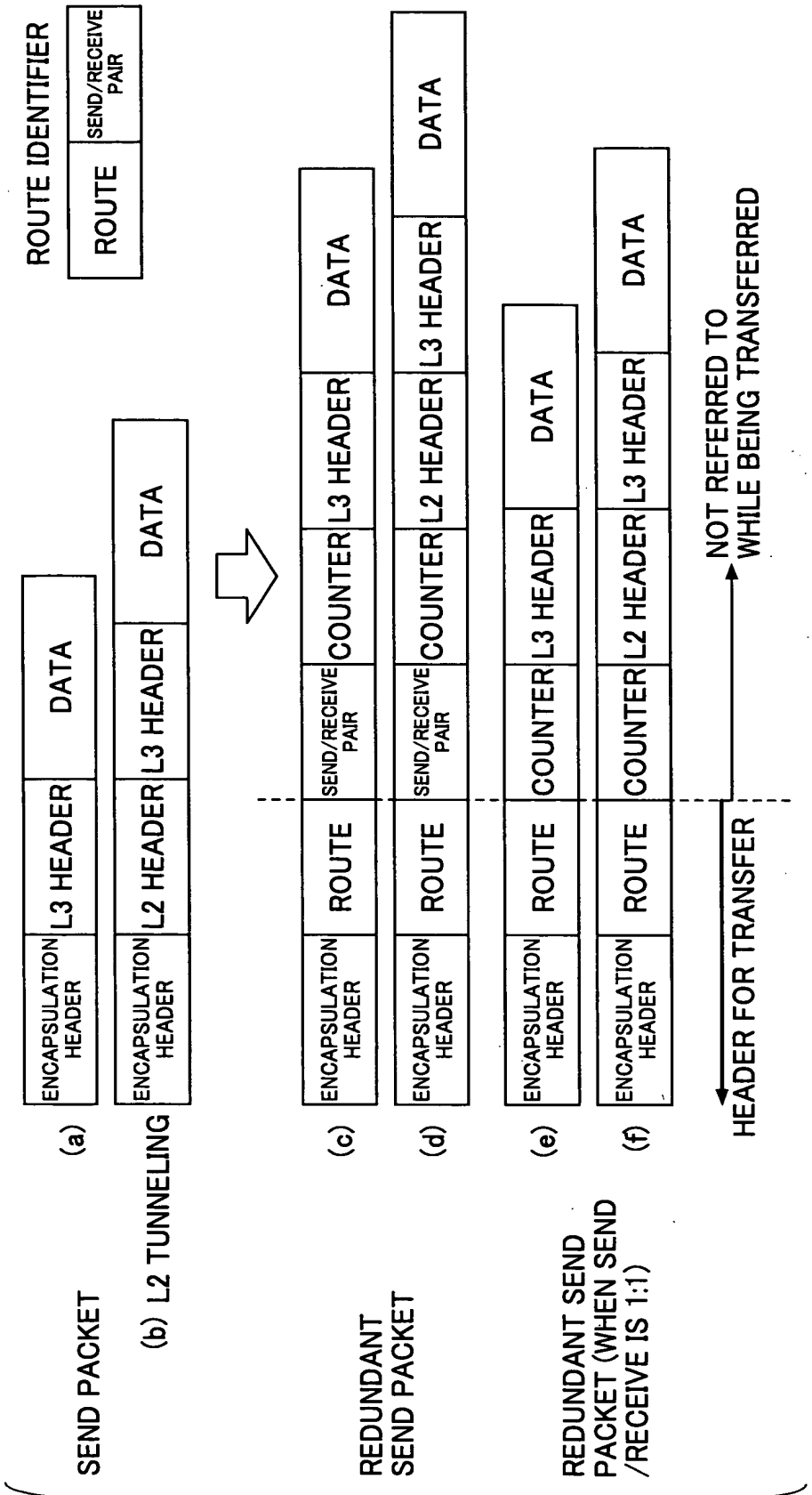
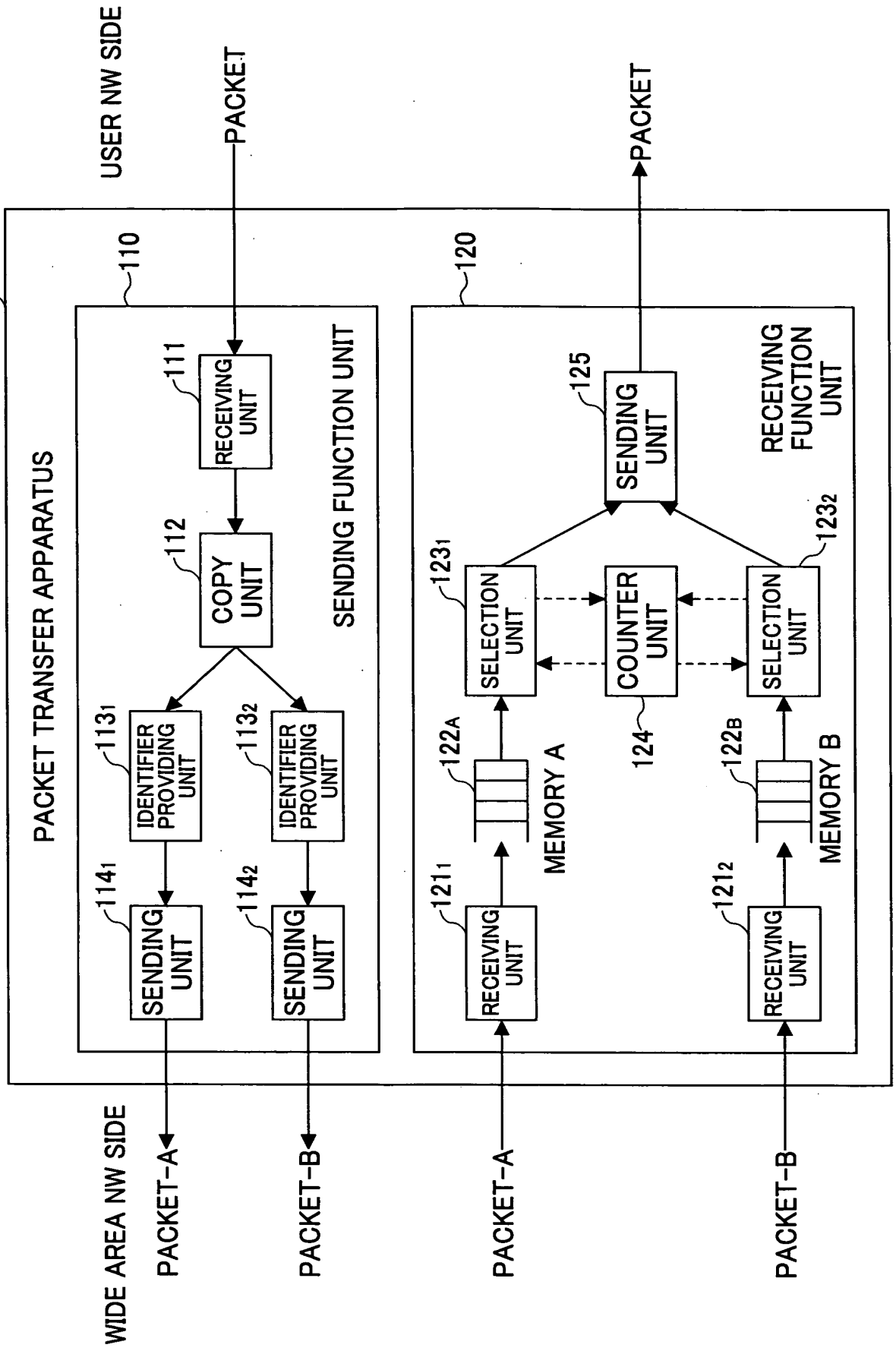

ROUTE IDENTIFIER
ROUTE
SEND/RECEIVE PAIR
SEND PACKET
(a)
ENCAPSULATION HEADER
L3 HEADER
DATA
(b) L2 TUNNELING
ENCAPSULATION HEADER
L2 HEADER
L3 HEADER
DATA
REDUNDANT SEND PACKET
(c)
ENCAPSULATION HEADER
ROUTE
SEND/RECEIVE PAIR
COUNTER
L3 HEADER
DATA
(d)
ENCAPSULATION HEADER
ROUTE
SEND/RECEIVE PAIR
COUNTER
L2 HEADER
L3 HEADER
DATA
REDUNDANT SEND PACKET (WHEN SEND /RECEIVE IS 1:1)
(e)
ENCAPSULATION HEADER
ROUTE
COUNTER
L3 HEADER
DATA
(f)
ENCAPSULATION HEADER
ROUTE
COUNTER
L2 HEADER
L3 HEADER
DATA
NOT REFERRED TO WHILE BEING TRANSFERRED
HEADER FOR TRANSFER

FIG.7

FIG.8


USER NW SIDE
PACKET
PACKET
100
PACKET TRANSFER APPARATUS
110
120
111
RECEIVING UNIT
SENDING FUNCTION UNIT
112
COPY UNIT
113₁
IDENTIFIER PROVIDING UNIT
113₂
IDENTIFIER PROVIDING UNIT
114₁
SENDING UNIT
114₂
SENDING UNIT
125
SENDING UNIT
RECEIVING FUNCTION UNIT
123₁
SELECTION UNIT
COUNTER UNIT
124
123₂
SELECTION UNIT
122A
MEMORY A
122B
MEMORY B
121₁
RECEIVING UNIT
121₂
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B
PACKET-A
PACKET-B

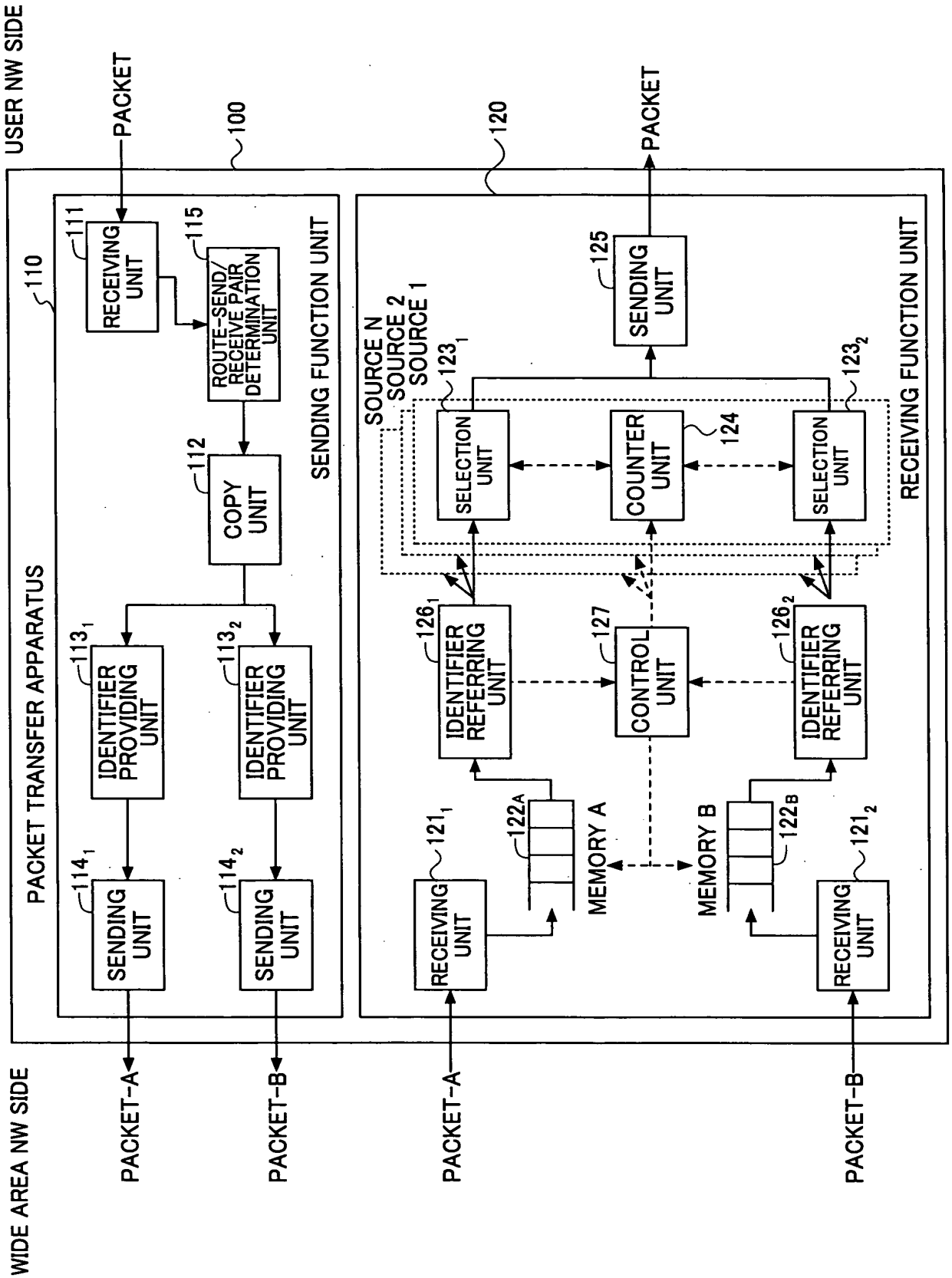

USER NW SIDE
PACKET
100
120
PACKET
PACKET TRANSFER APPARATUS
110
SENDING FUNCTION UNIT
RECEIVING FUNCTION UNIT
111
RECEIVING UNIT
115
ROUTE-SEND/ RECEIVE PAIR DETERMINATION UNIT
112
COPY UNIT
125
SENDING UNIT
SOURCE N
SOURCE 2
SOURCE 1
123 1
123 2
SELECTION UNIT
COUNTER UNIT
124
SELECTION UNIT
113 1
IDENTIFIER PROVIDING UNIT
113 2
IDENTIFIER PROVIDING UNIT
126 1
IDENTIFIER REFERRING UNIT
127
CONTROL UNIT
126 2
IDENTIFIER REFERRING UNIT
114 1
SENDING UNIT
114 2
SENDING UNIT
121 1
RECEIVING UNIT
122A
MEMORY A
MEMORY B
122B
121 2
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B
PACKET-A
PACKET-B

FIG.9

FIG.10

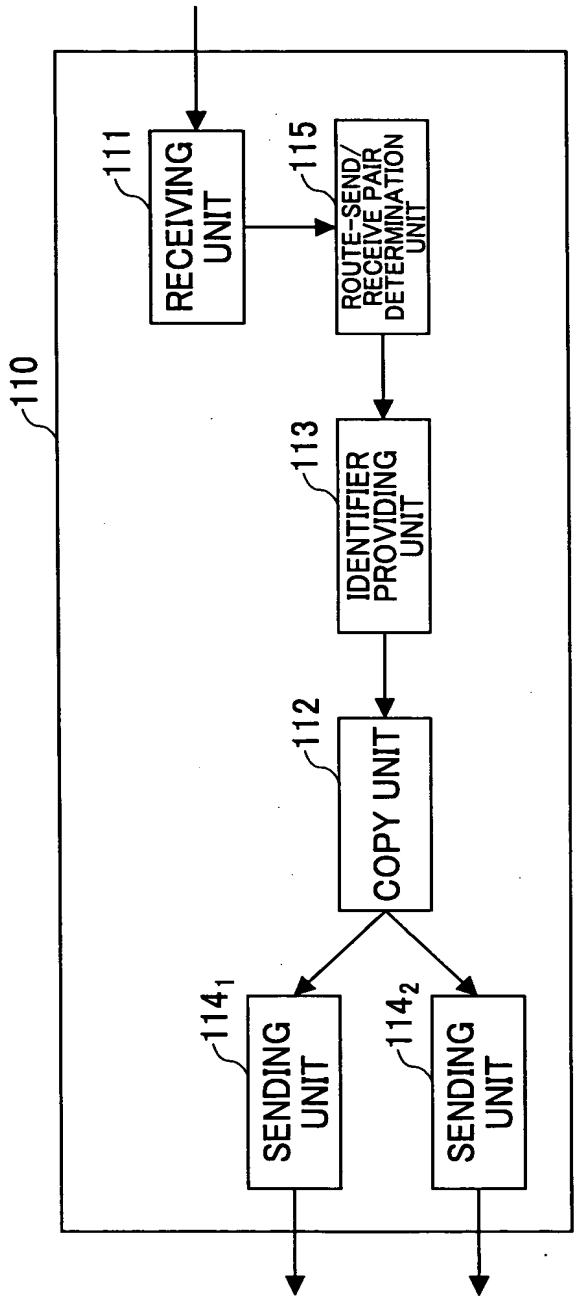

110
111
RECEIVING UNIT
115
ROUTE-SEND/ RECEIVE PAIR DETERMINATION UNIT
113
IDENTIFIER PROVIDING UNIT
112
COPY UNIT
114_1
SENDING UNIT
114_2
SENDING UNIT

FIG.11

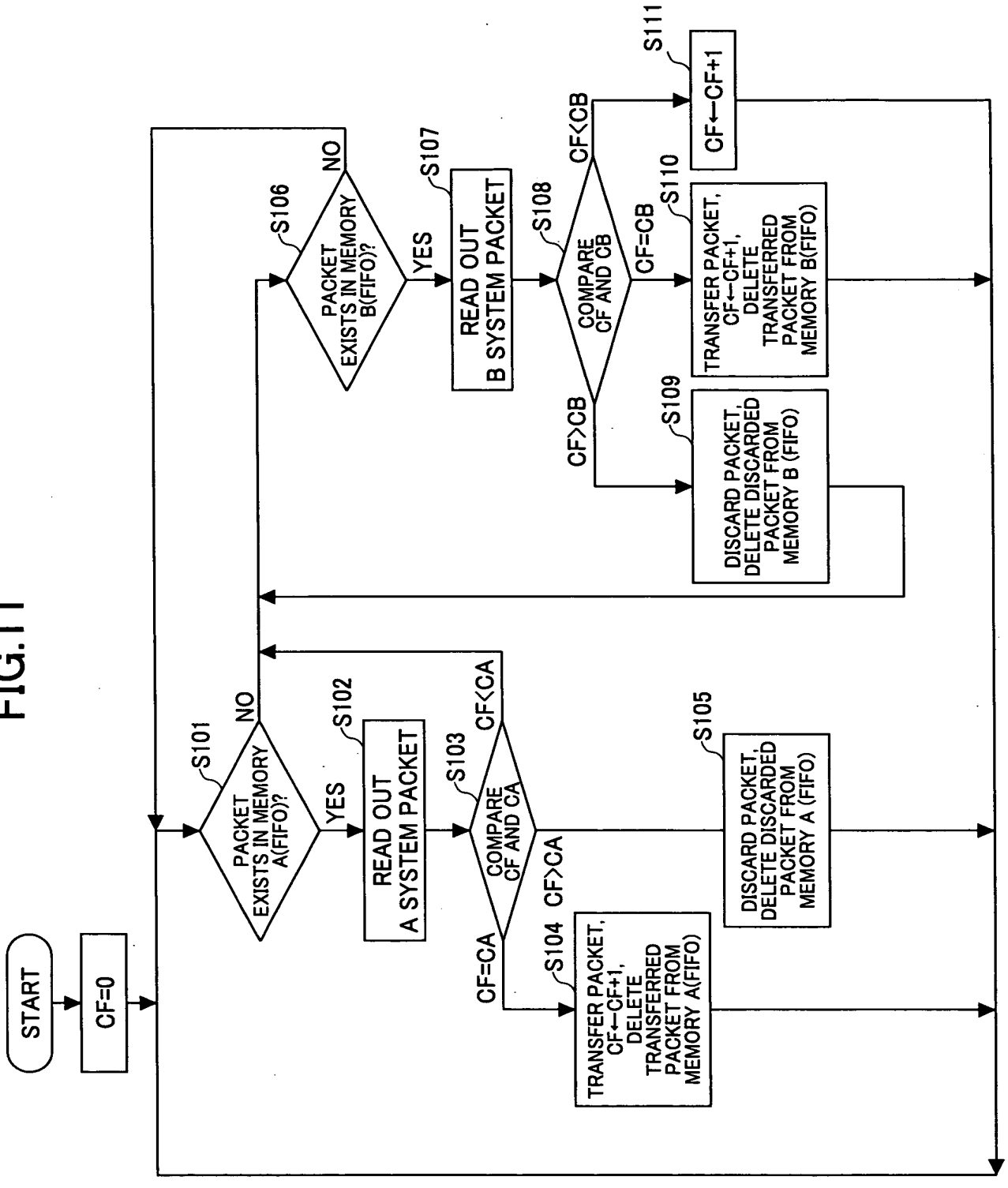
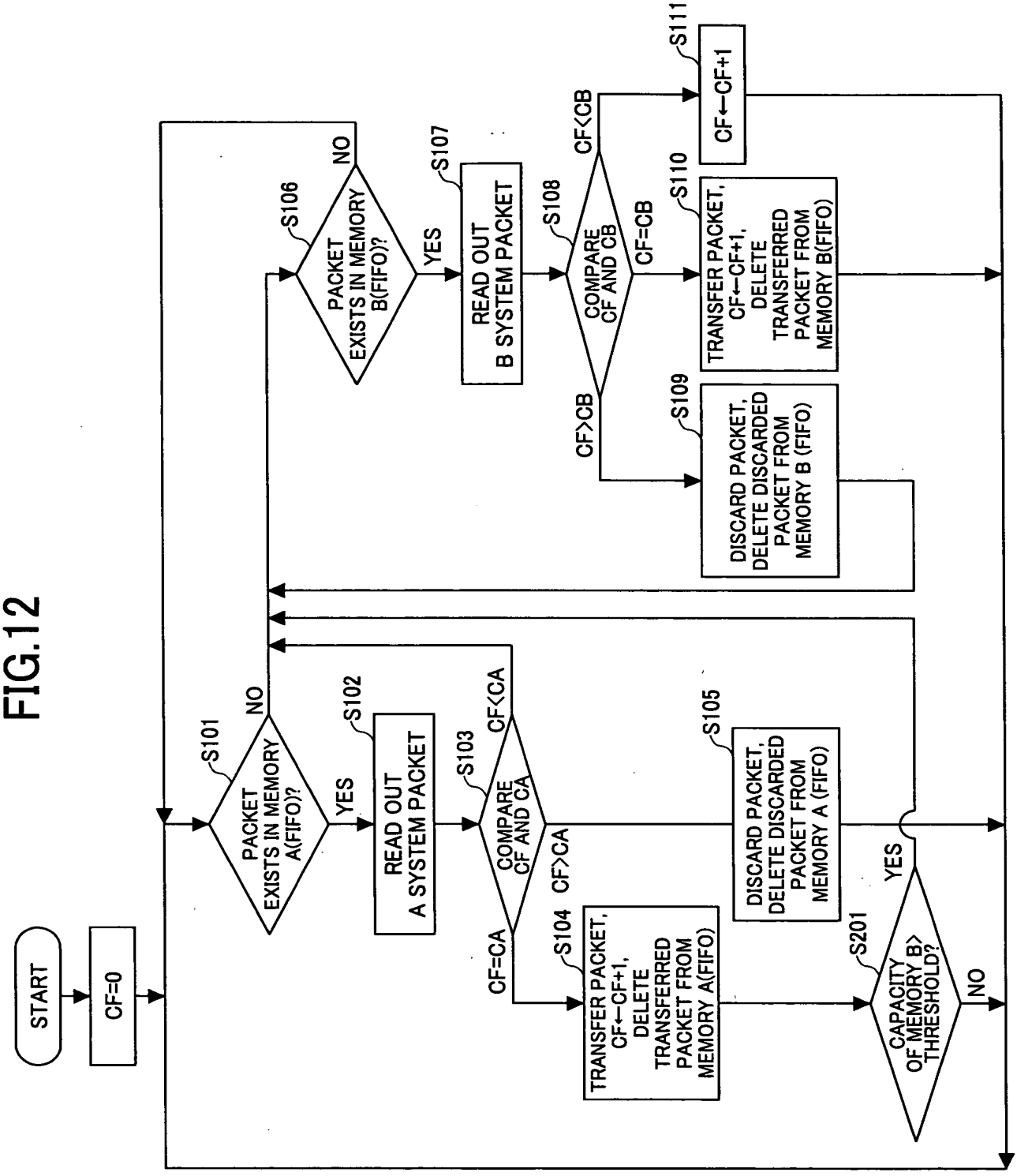

START
CF=0
S101
PACKET EXISTS IN MEMORY A(FIFO)?
NO
YES
S102
READ OUT A SYSTEM PACKET
S103
COMPARE CF AND CA
CF<CA
CF=CA
CF>CA
S104
TRANSFER PACKET, CF←CF+1, DELETE TRANSFERRED PACKET FROM MEMORY A(FIFO)
S105
DISCARD PACKET, DELETE DISCARDED PACKET FROM MEMORY A (FIFO)
S106
PACKET EXISTS IN MEMORY B(FIFO)?
NO
YES
S107
READ OUT B SYSTEM PACKET
S108
COMPARE CF AND CB
CF<CB
CF=CB
CF>CB
S109
DISCARD PACKET, DELETE DISCARDED PACKET FROM MEMORY B (FIFO)
S110
TRANSFER PACKET, CF←CF+1, DELETE TRANSFERRED PACKET FROM MEMORY B(FIFO)
S111
CF←CF+1

FIG.12


START
CF=0
S101
PACKET EXISTS IN MEMORY A(FIFO)?
NO
YES
S102
READ OUT A SYSTEM PACKET
S103
COMPARE CF AND CA
CF<CA
CF=CA
CF>CA
S104
TRANSFER PACKET, CF←CF+1, DELETE TRANSFERRED PACKET FROM MEMORY A(FIFO)
S105
DISCARD PACKET, DELETE DISCARDED PACKET FROM MEMORY A (FIFO)
S201
CAPACITY OF MEMORY B> THRESHOLD?
YES
NO
S106
PACKET EXISTS IN MEMORY B(FIFO)?
NO
YES
S107
READ OUT B SYSTEM PACKET
S108
COMPARE CF AND CB
CF<CB
CF=CB
CF>CB
S109
DISCARD PACKET, DELETE DISCARDED PACKET FROM MEMORY B (FIFO)
S110
TRANSFER PACKET, CF←CF+1, DELETE TRANSFERRED PACKET FROM MEMORY B(FIFO)
S111
CF←CF+1

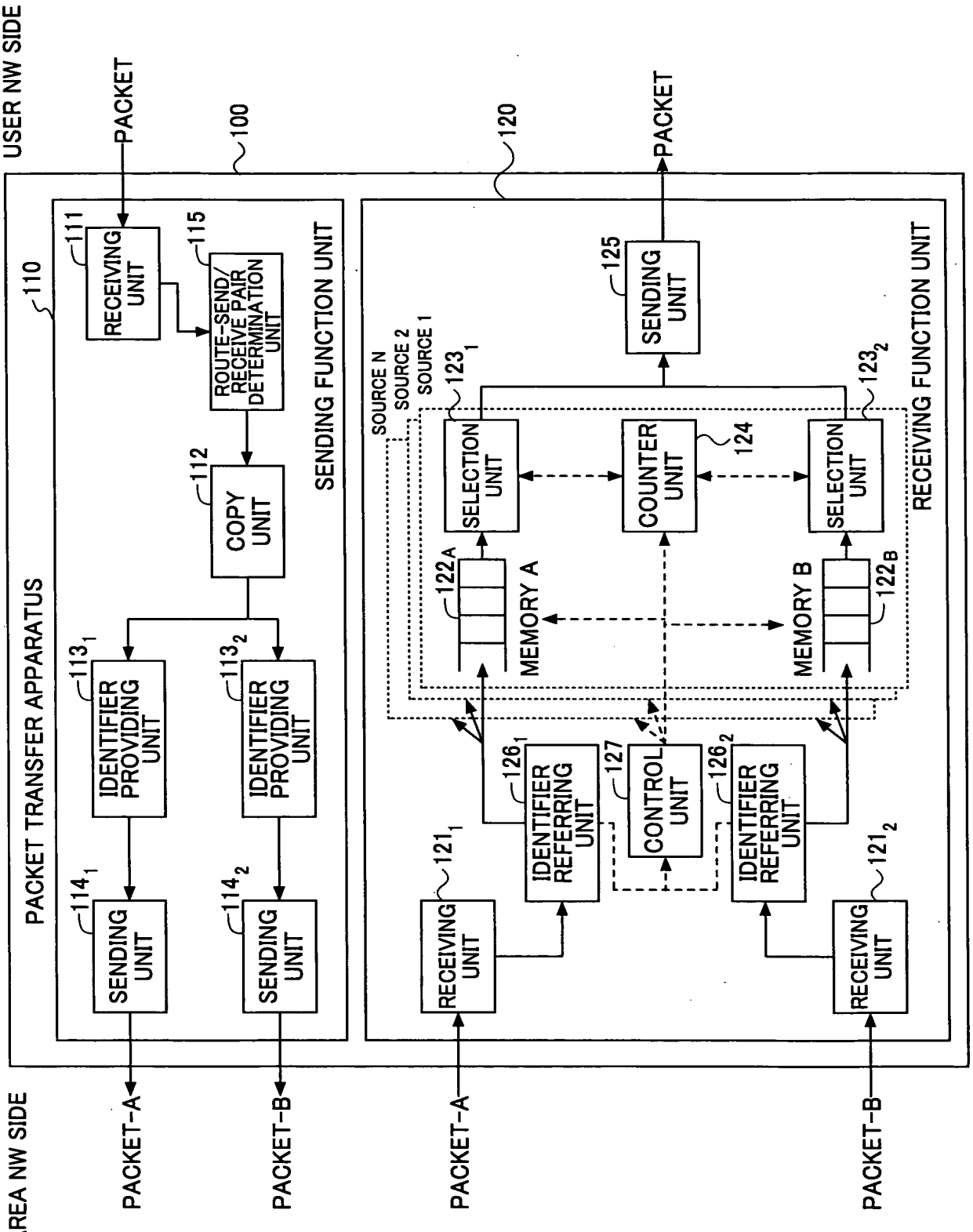

USER NW SIDE
PACKET
100
120
PACKET
110
111
RECEIVING UNIT
115
ROUTE-SEND/ RECEIVE PAIR DETERMINATION UNIT
SENDING FUNCTION UNIT
125
SENDING UNIT
SOURCE N
SOURCE 2
SOURCE 1
123 1
123 2
SELECTION UNIT
COUNTER UNIT
124
SELECTION UNIT
RECEIVING FUNCTION UNIT
112
COPY UNIT
122A
MEMORY A
MEMORY B
122B
PACKET TRANSFER APPARATUS
113 1
IDENTIFIER PROVIDING UNIT
113 2
IDENTIFIER PROVIDING UNIT
126 1
IDENTIFIER REFERRING UNIT
127
CONTROL UNIT
126 2
IDENTIFIER REFERRING UNIT
114 1
SENDING UNIT
114 2
SENDING UNIT
121 1
RECEIVING UNIT
121 2
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B
PACKET-A
PACKET-B

FIG.13

FIG.14

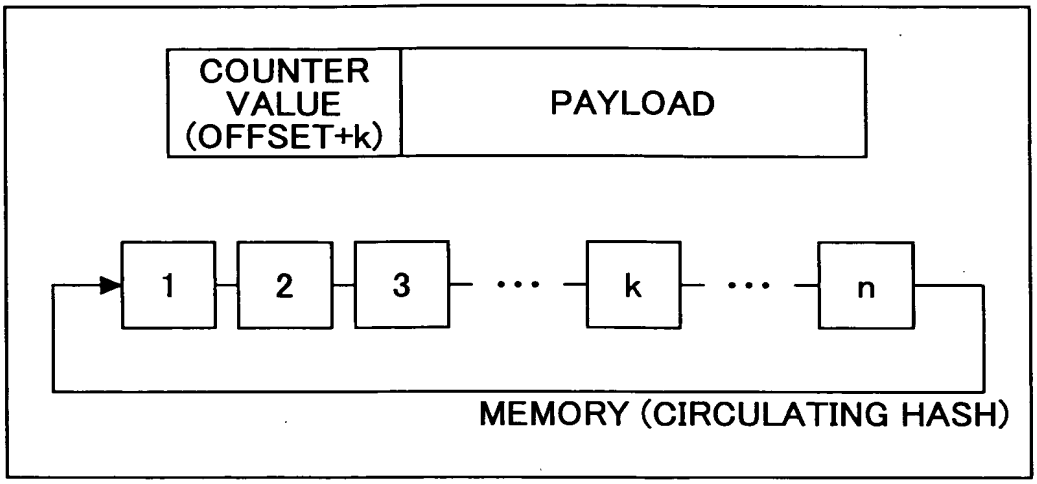

COUNTER VALUE (OFFSET+k)
PAYLOAD
1
2
3
k
n
MEMORY (CIRCULATING HASH)

FIG.15

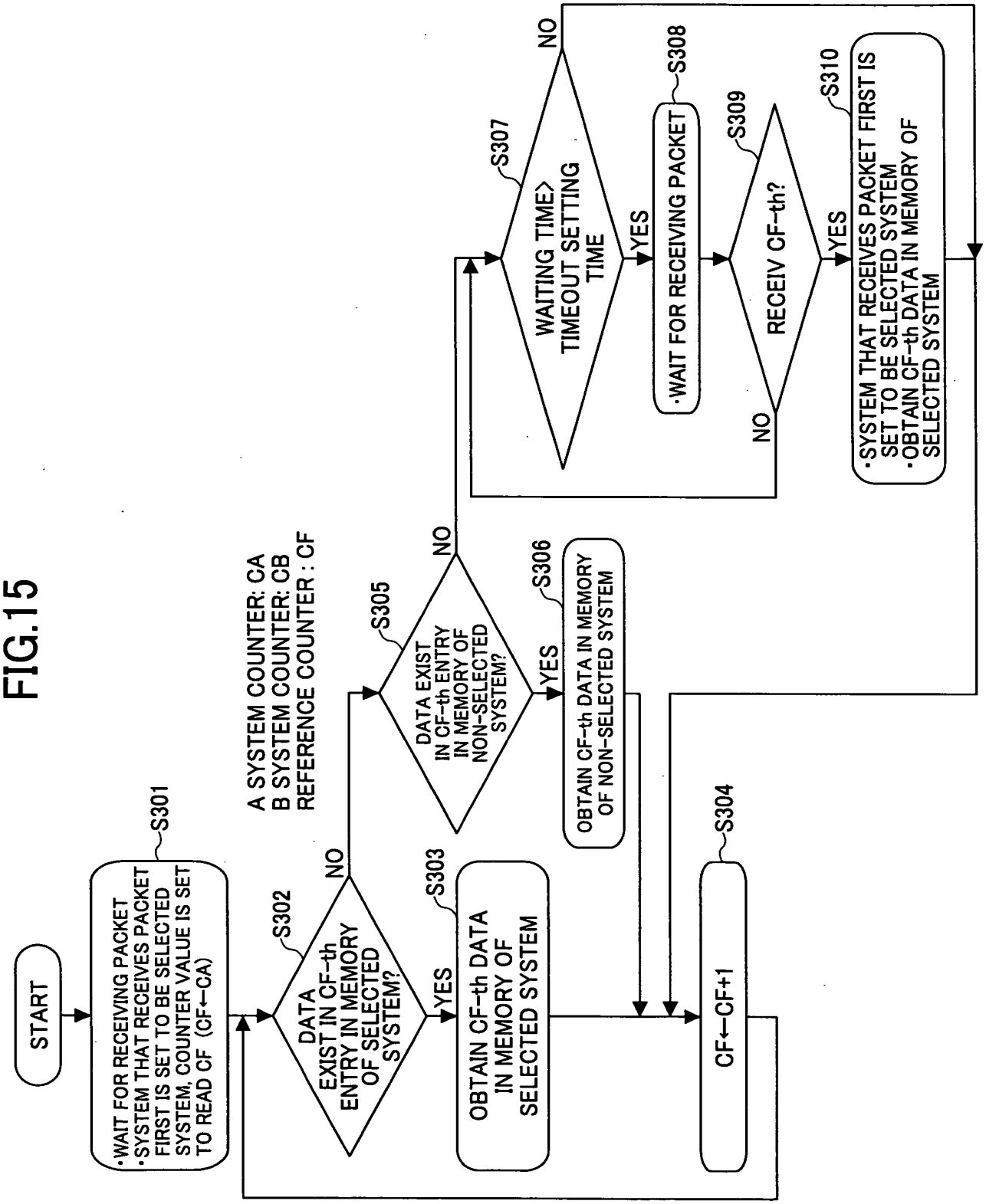

START
S301
·WAIT FOR RECEIVING PACKET
·SYSTEM THAT RECEIVES PACKET FIRST IS SET TO BE SELECTED SYSTEM, COUNTER VALUE IS SET TO READ CF (CF←CA)
A SYSTEM COUNTER: CA
B SYSTEM COUNTER: CB
REFERENCE COUNTER : CF
S302
DATA EXIST IN CF-th ENTRY IN MEMORY OF SELECTED SYSTEM?
NO
YES
S303
OBTAIN CF-th DATA IN MEMORY OF SELECTED SYSTEM
S305
DATA EXIST IN CF-th ENTRY IN MEMORY OF NON-SELECTED SYSTEM?
NO
YES
S306
OBTAIN CF-th DATA IN MEMORY OF NON-SELECTED SYSTEM
S304
CF←CF+1
S307
WAITING TIME> TIMEOUT SETTING TIME
NO
YES
S308
·WAIT FOR RECEIVING PACKET
S309
RECEIV CF-th?
NO
YES
S310
·SYSTEM THAT RECEIVES PACKET FIRST IS SET TO BE SELECTED SYSTEM
·OBTAIN CF-th DATA IN MEMORY OF SELECTED SYSTEM

FIG.16

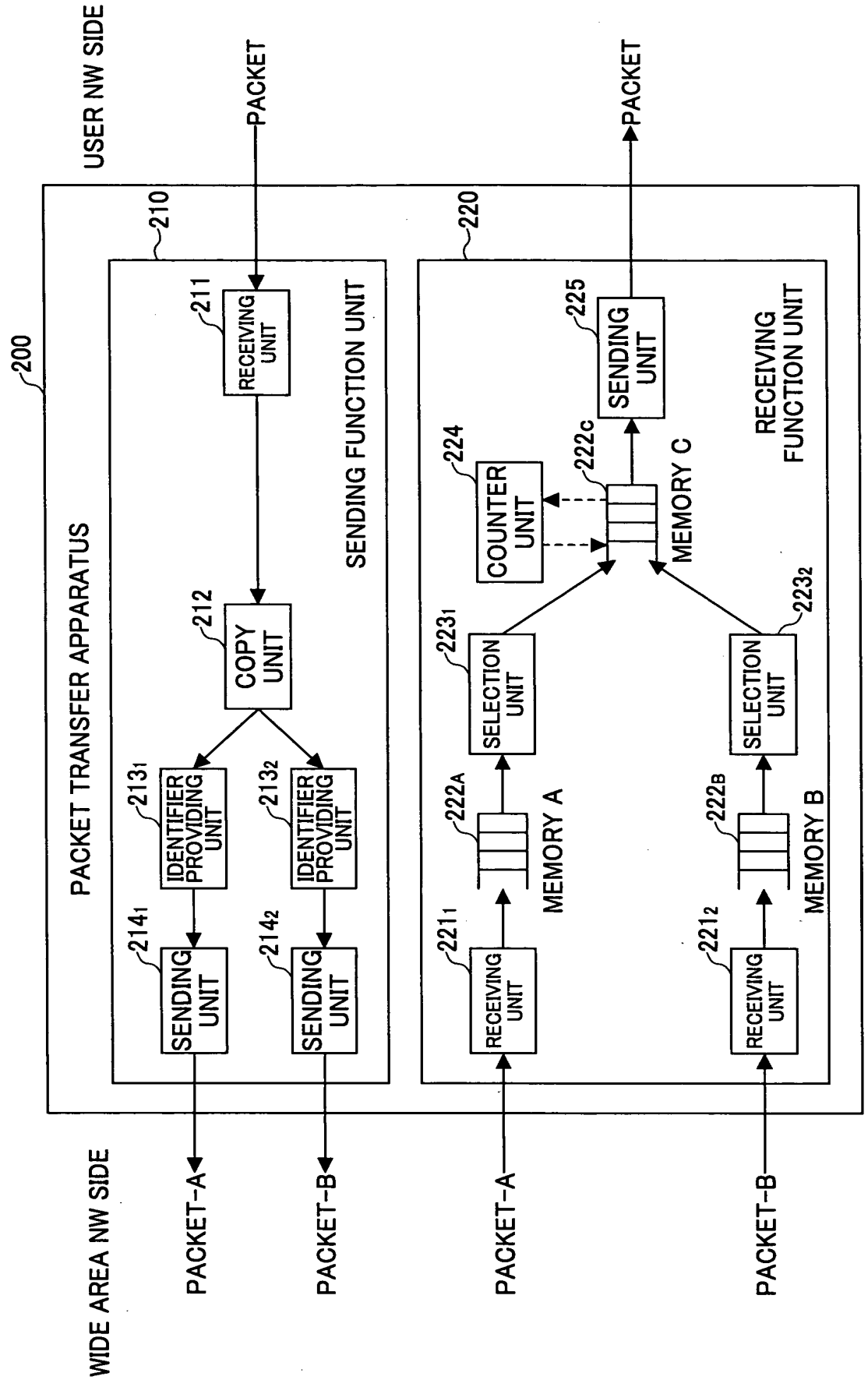

USER NW SIDE
PACKET
PACKET
200
210
220
211
RECEIVING UNIT
SENDING FUNCTION UNIT
RECEIVING FUNCTION UNIT
225
SENDING UNIT
224
COUNTER UNIT
222C
MEMORY C
212
COPY UNIT
PACKET TRANSFER APPARATUS
223₁
SELECTION UNIT
223₂
SELECTION UNIT
213₁
IDENTIFIER PROVIDING UNIT
213₂
IDENTIFIER PROVIDING UNIT
222A
MEMORY A
222B
MEMORY B
214₁
SENDING UNIT
214₂
SENDING UNIT
221₁
RECEIVING UNIT
221₂
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B
PACKET-A
PACKET-B

FIG.17

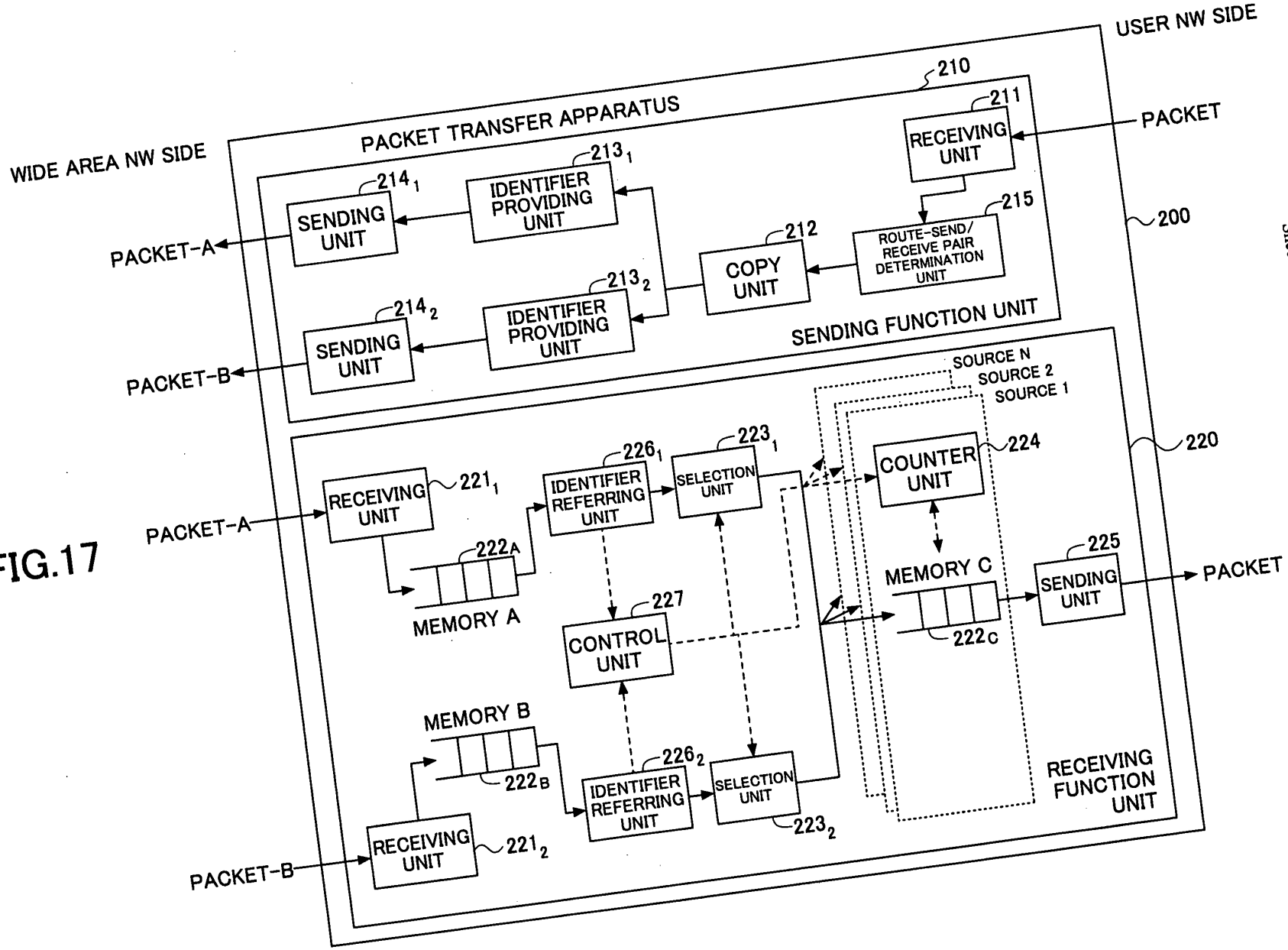
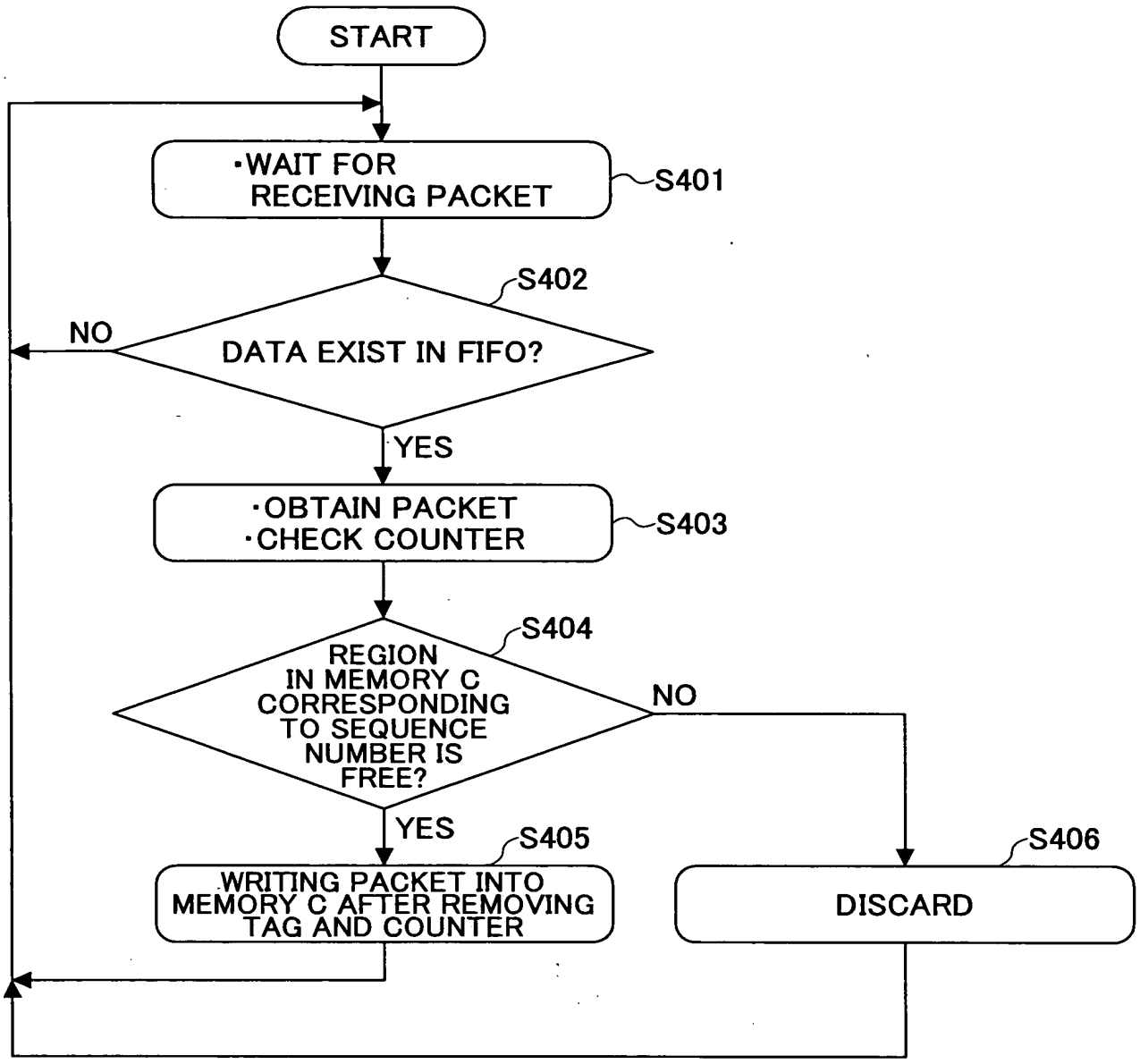


FIG.18


START
·WAIT FOR RECEIVING PACKET
S401
S402
DATA EXIST IN FIFO?
NO
YES
·OBTAIN PACKET
·CHECK COUNTER
S403
S404
REGION IN MEMORY C CORRESPONDING TO SEQUENCE NUMBER IS FREE?
NO
YES
S405
WRITING PACKET INTO MEMORY C AFTER REMOVING TAG AND COUNTER
S406
DISCARD

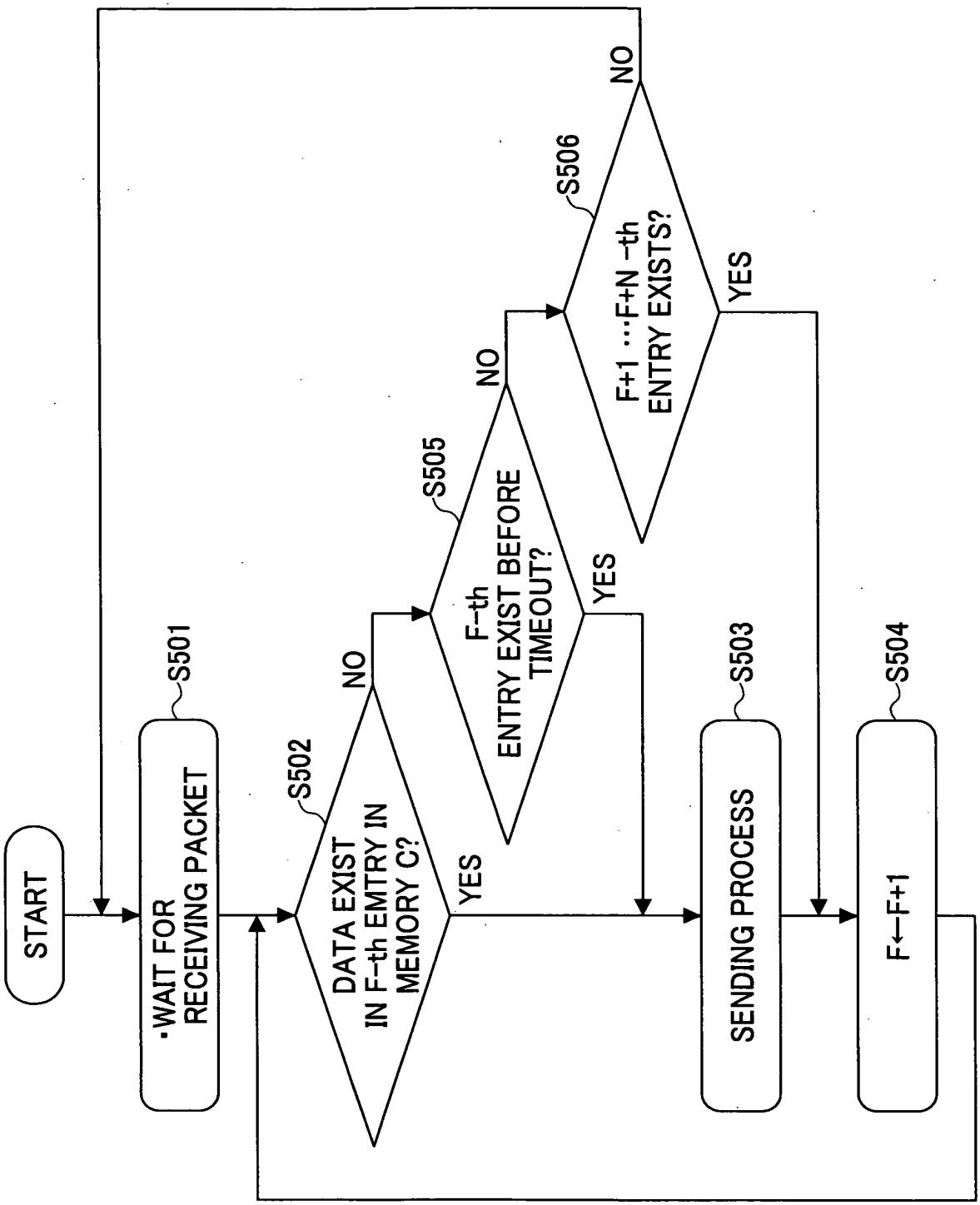

START
WAIT FOR RECEIVING PACKET
S501
DATA EXIST IN F-th EMTRY IN MEMORY C?
S502
NO
YES
F-th ENTRY EXIST BEFORE TIMEOUT?
S505
NO
YES
F+1 ···F+N -th ENTRY EXISTS?
S506
NO
YES
SENDING PROCESS
S503
F←F+1
S504

FIG.19

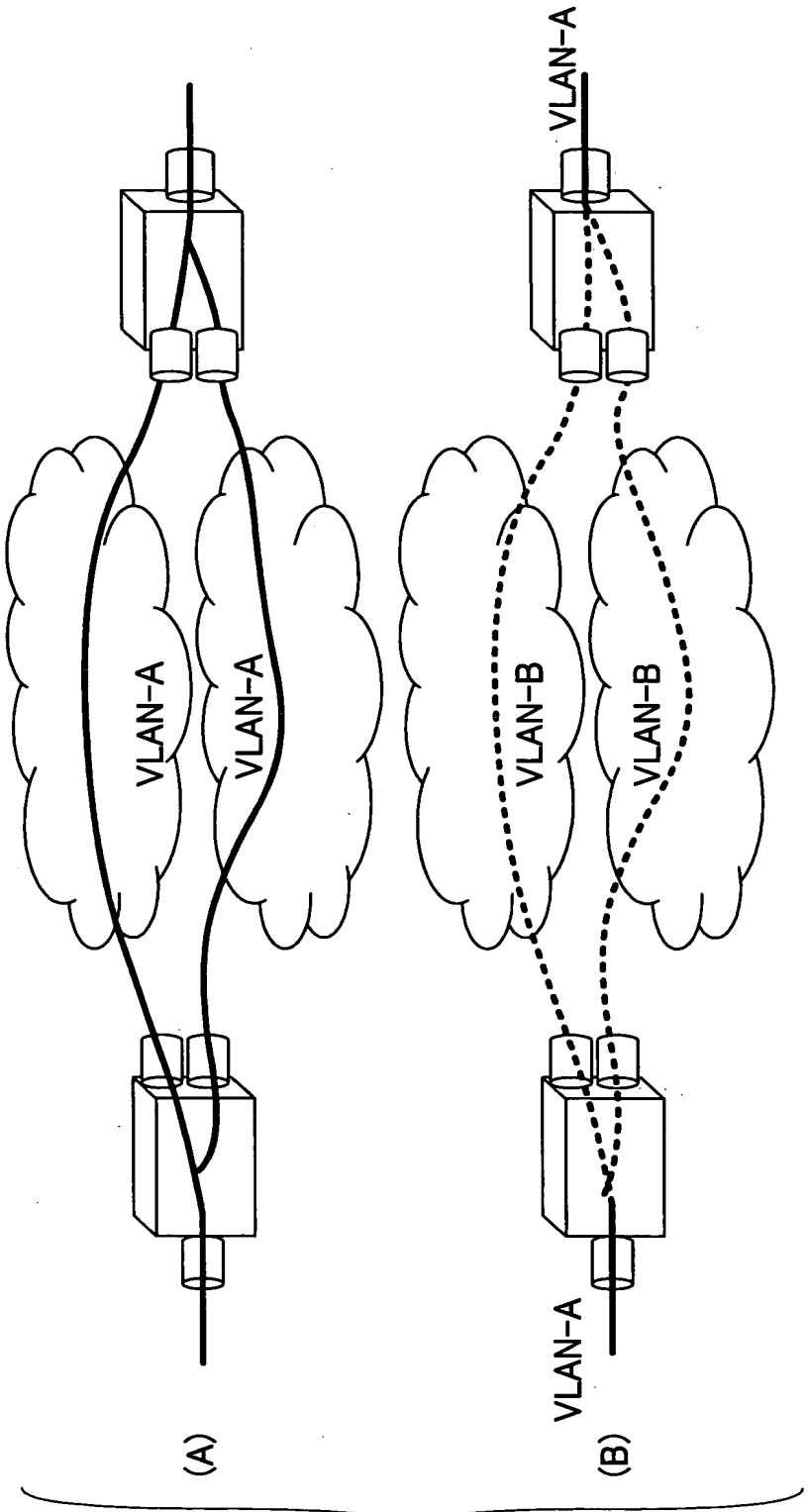


FIG.20

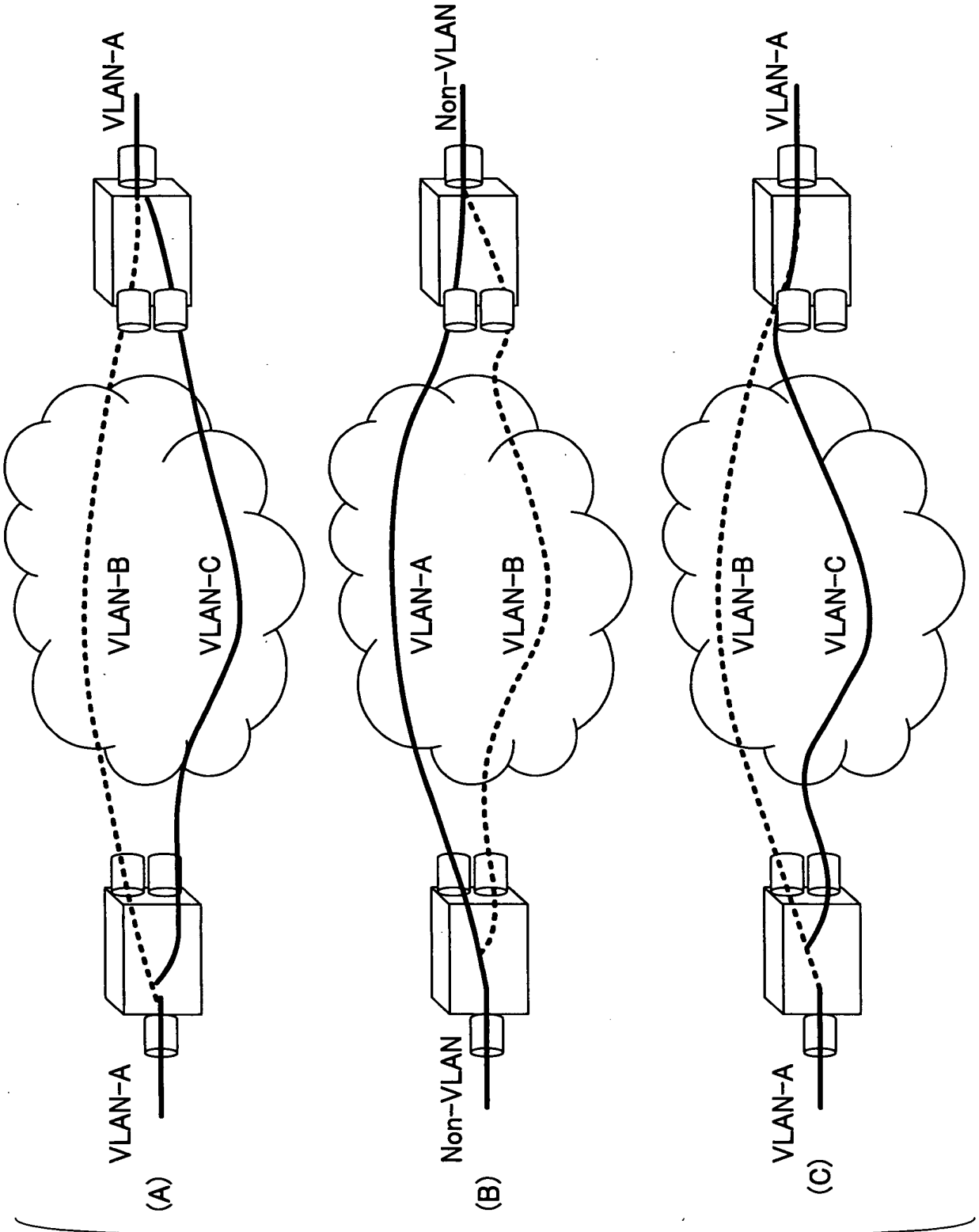

VLAN-A
VLAN-B
VLAN-C
VLAN-A
(A)
Non-VLAN
VLAN-A
VLAN-B
Non-VLAN
(B)
VLAN-A
VLAN-B
VLAN-C
VLAN-A
(C)

FIG.21

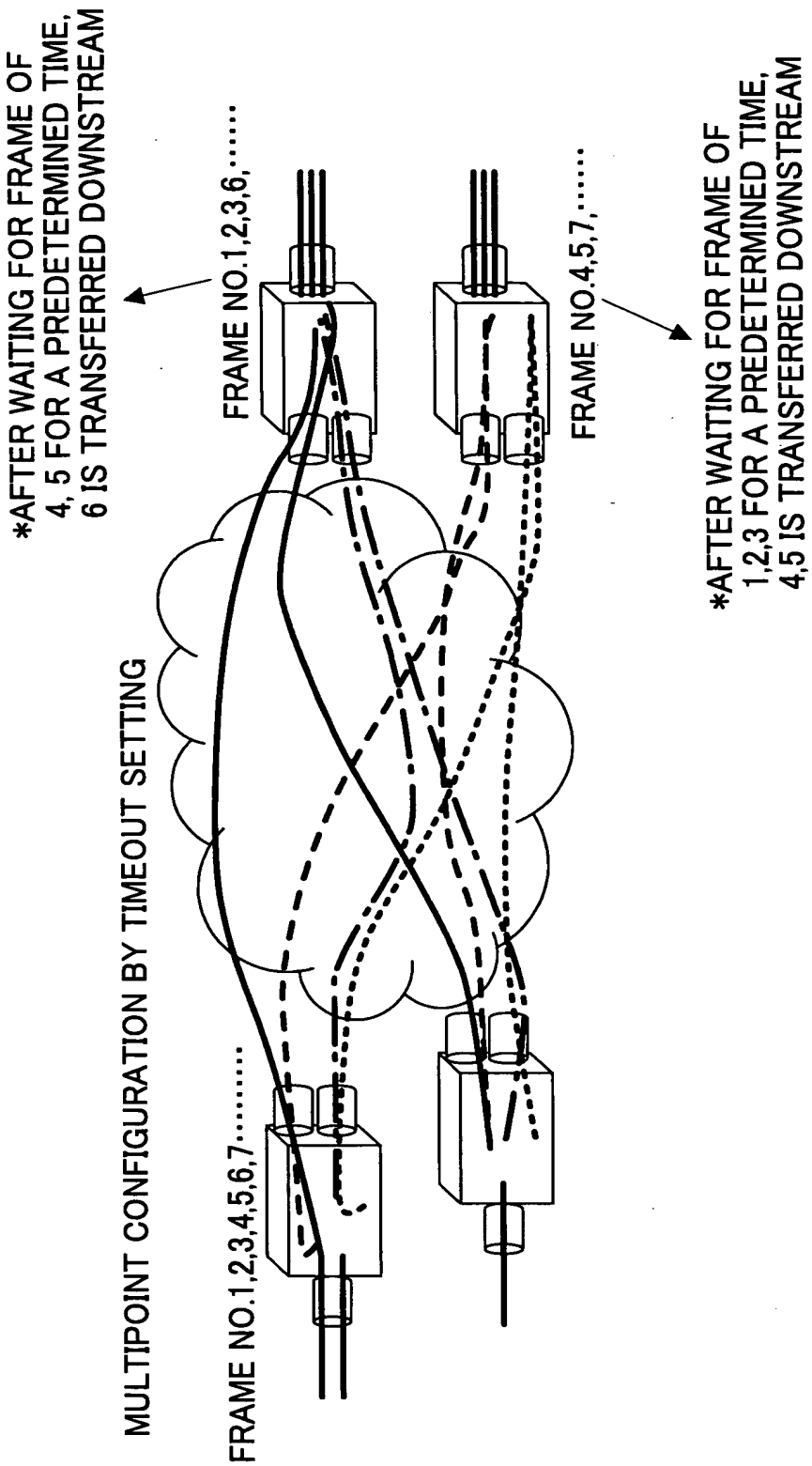

*AFTER WAITING FOR FRAME OF
4, 5 FOR A PREDETERMINED TIME,
6 IS TRANSFERRED DOWNSTREAM
FRAME NO.1,2,3,6,.....
FRAME NO.4,5,7,.....
*AFTER WAITING FOR FRAME OF
1,2,3 FOR A PREDETERMINED TIME,
4,5 IS TRANSFERRED DOWNSTREAM
MULTIPOINT CONFIGURATION BY TIMEOUT SETTING
FRAME NO.1,2,3,4,5,6,7.....

FIG.22

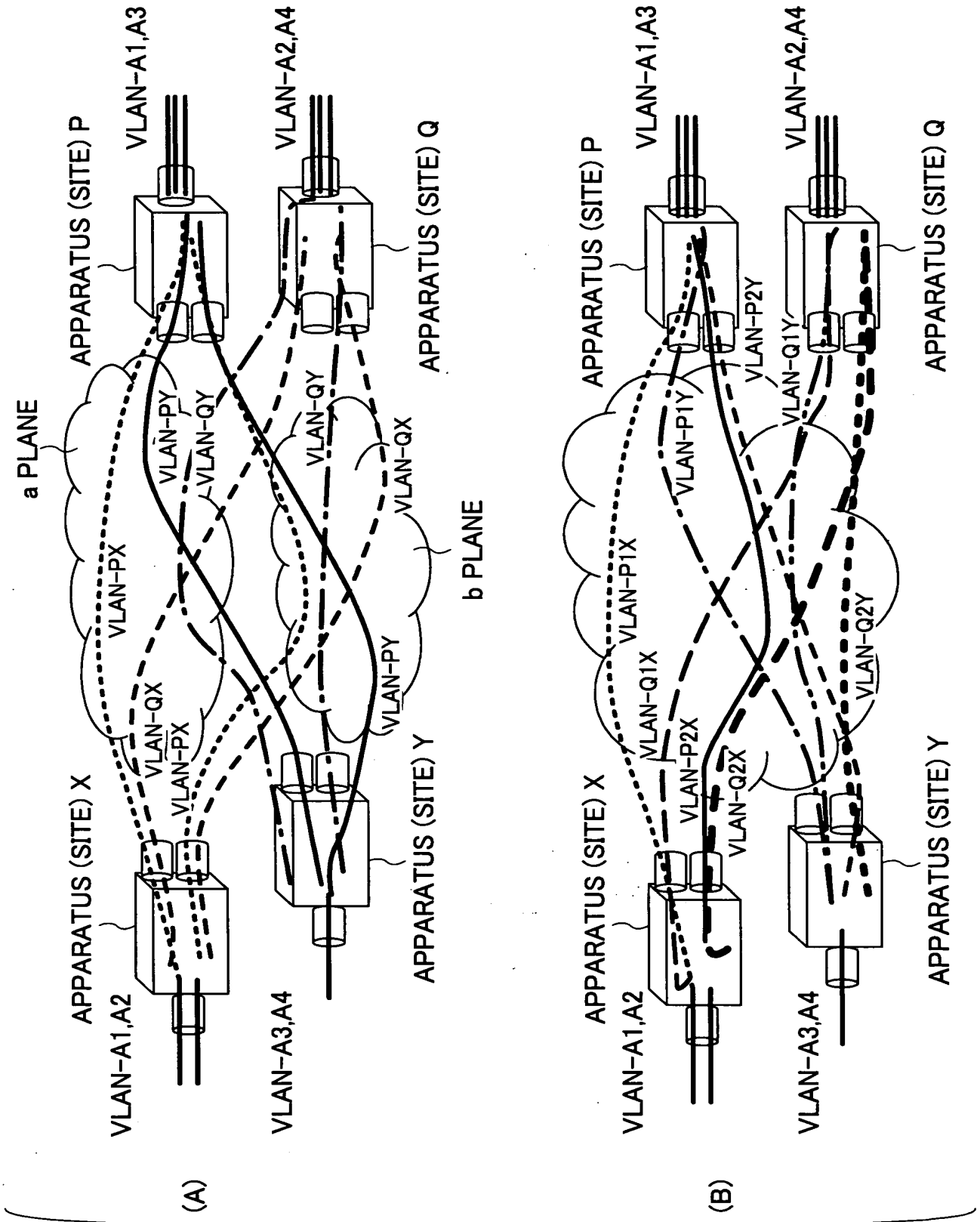

(A)
APPARATUS (SITE) X
APPARATUS (SITE) P
APPARATUS (SITE) Q
APPARATUS (SITE) Y
VLAN-A1,A2
VLAN-A1,A3
VLAN-A2,A4
VLAN-A3,A4
a PLANE
b PLANE
VLAN-PX
VLAN-QX
VLAN-PY
VLAN-QY
(B)
VLAN-P1X
VLAN-Q1X
VLAN-P2X
VLAN-Q2X
VLAN-P1Y
VLAN-Q1Y
VLAN-P2Y
VLAN-Q2Y

FIG.23

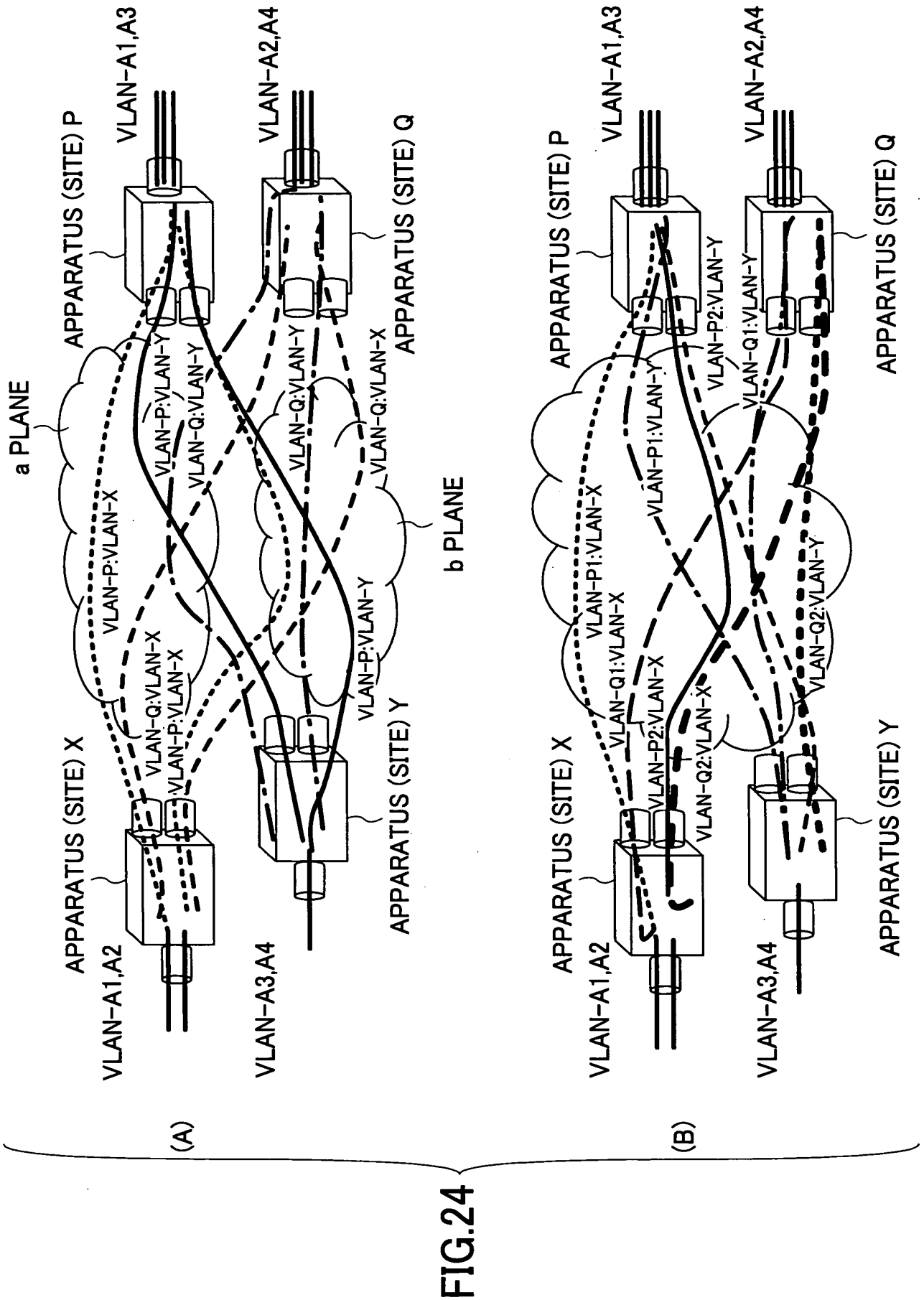

(A)
a PLANE
b PLANE
APPARATUS (SITE) P
APPARATUS (SITE) Q
APPARATUS (SITE) X
APPARATUS (SITE) Y
VLAN-A1,A3
VLAN-A2,A4
VLAN-A1,A2
VLAN-A3,A4
VLAN-P:VLAN-X
VLAN-Q:VLAN-X
VLAN-P:VLAN-Y
VLAN-Q:VLAN-Y
(B)
VLAN-P1:VLAN-X
VLAN-P2:VLAN-X
VLAN-Q1:VLAN-X
VLAN-Q2:VLAN-X
VLAN-P1:VLAN-Y
VLAN-P2:VLAN-Y
VLAN-Q1:VLAN-Y
VLAN-Q2:VLAN-Y

FIG.24

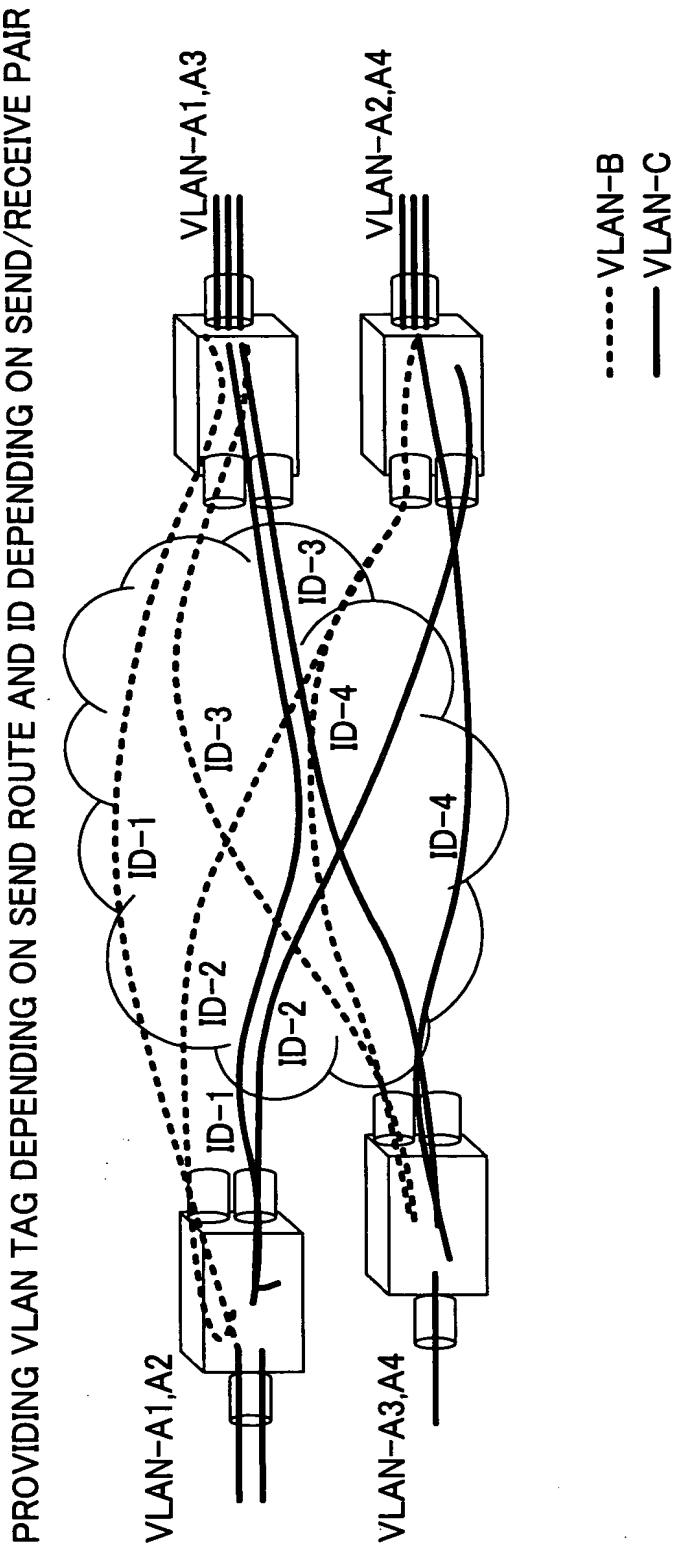

PROVIDING VLAN TAG DEPENDING ON SEND ROUTE AND ID DEPENDING ON SEND/RECEIVE PAIR
VLAN-A1,A3
VLAN-A2,A4
VLAN-A1,A2
VLAN-A3,A4
ID-1
ID-2
ID-3
ID-4
VLAN-B
VLAN-C

FIG.25

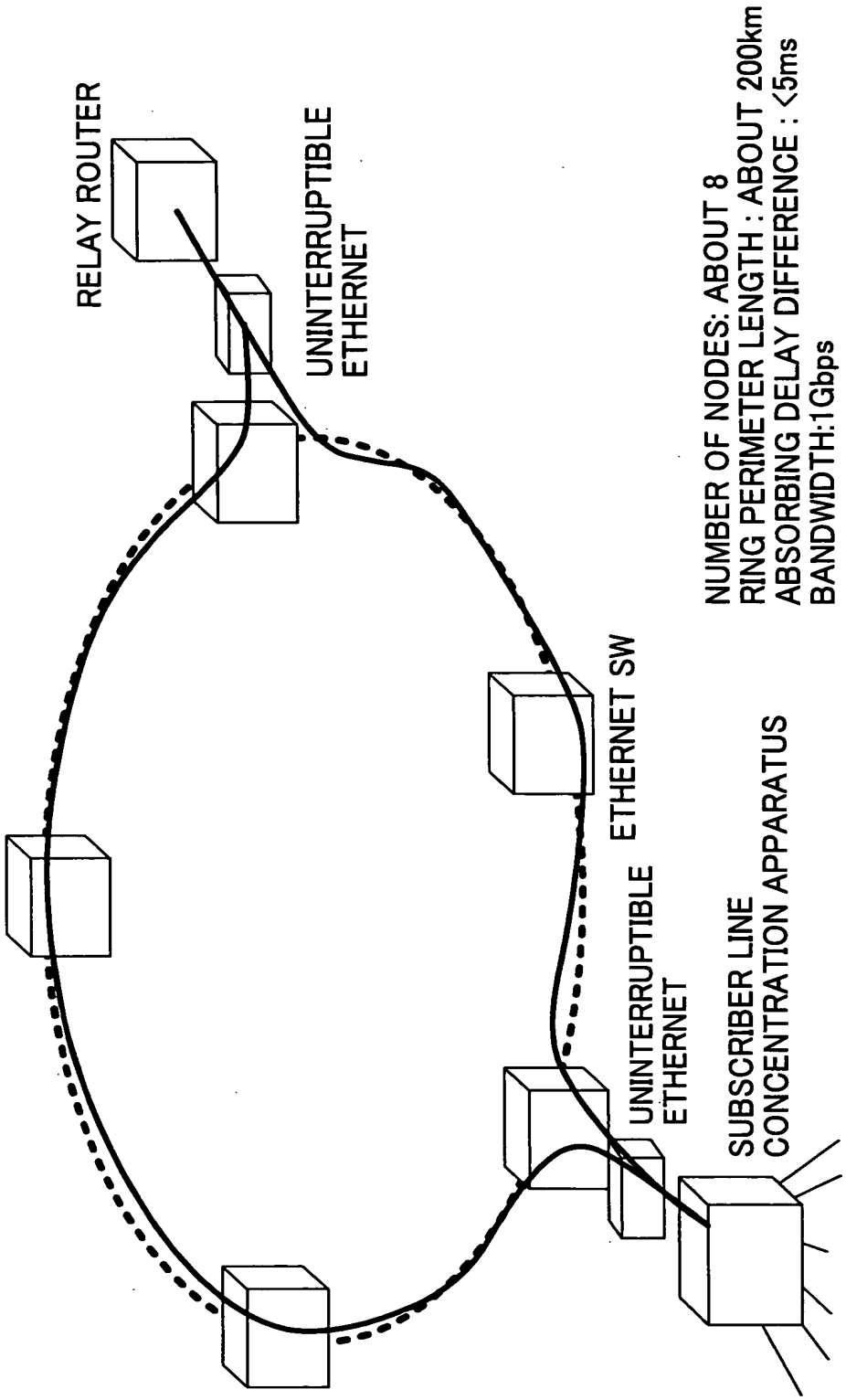
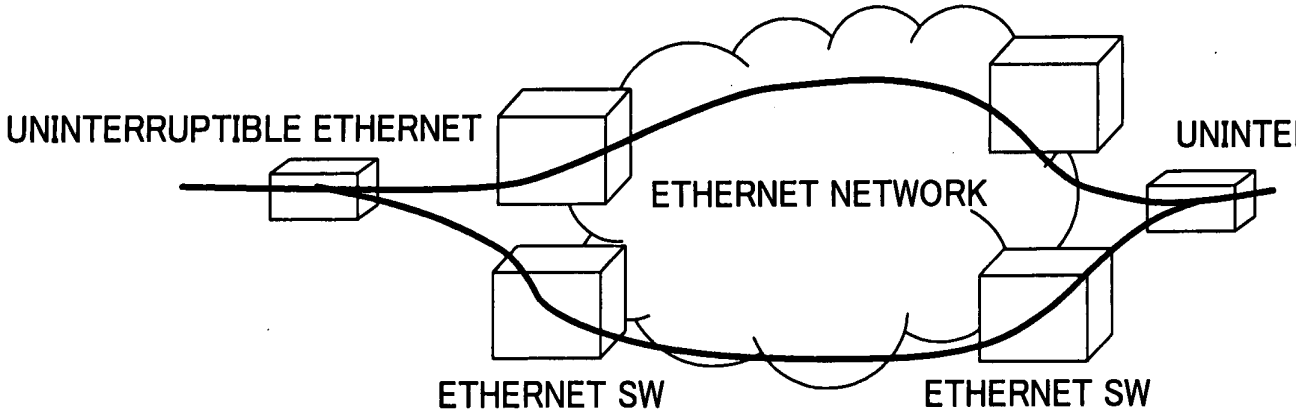

RELAY ROUTER
UNINTERRUPTIBLE ETHERNET
ETHERNET SW
UNINTERRUPTIBLE ETHERNET
SUBSCRIBER LINE CONCENTRATION APPARATUS
NUMBER OF NODES: ABOUT 8
RING PERIMETER LENGTH : ABOUT 200km
ABSORBING DELAY DIFFERENCE : <5ms
BANDWIDTH:1Gbps

FIG.26

FIG.27



NUMBER OF NODES: ABOUT 5-15
DISTANCE BETWEEN NODES: ABOUT 200-1000km
ABSORBING DELAY DIFFERENCE :<20ms
BANDWIDTH: 10M-1Gbps

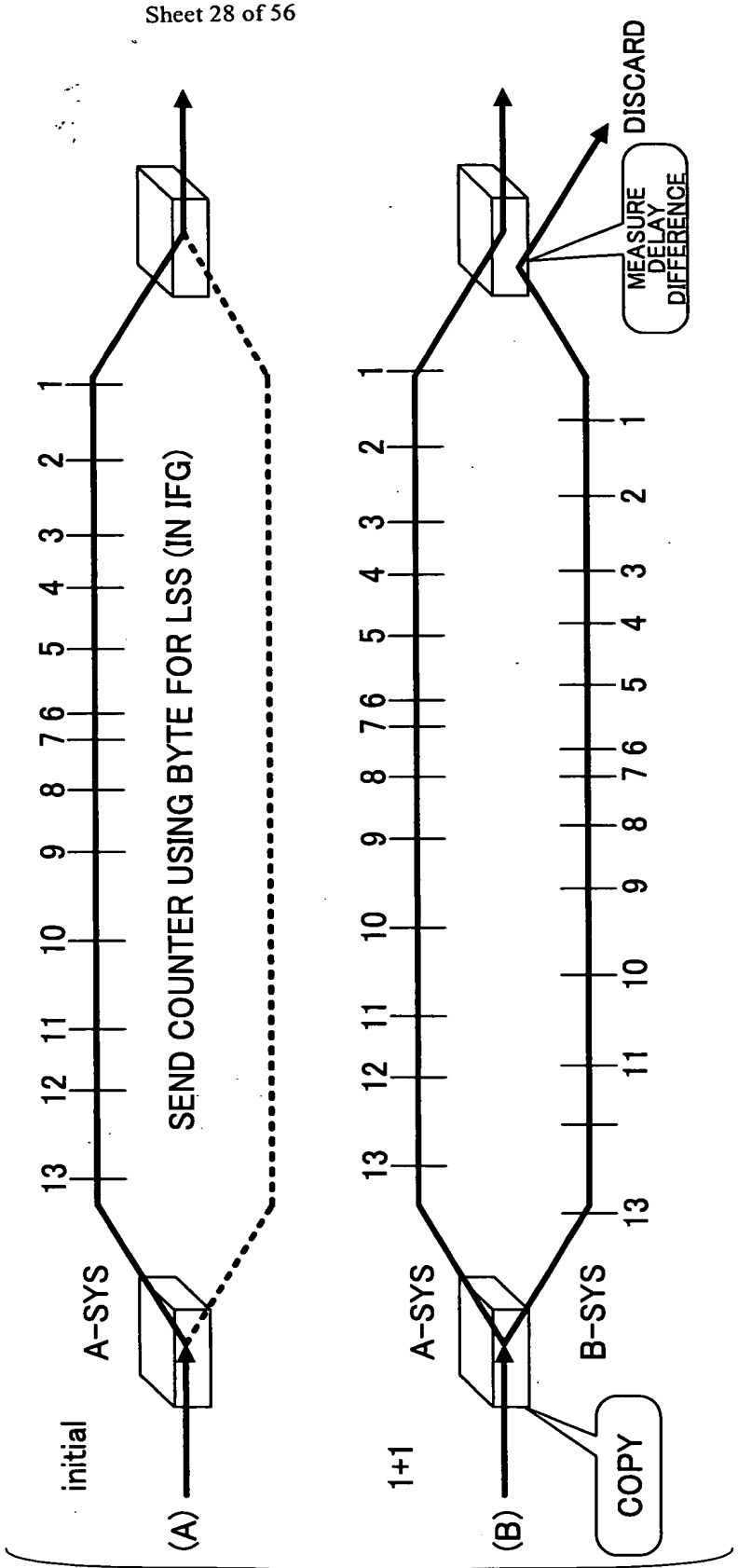

initial
A-SYS
SEND COUNTER USING BYTE FOR LSS (IN IFG)
(A)
1+1
A-SYS
B-SYS
DISCARD
MEASURE DELAY DIFFERENCE
COPY
(B)

FIG.28

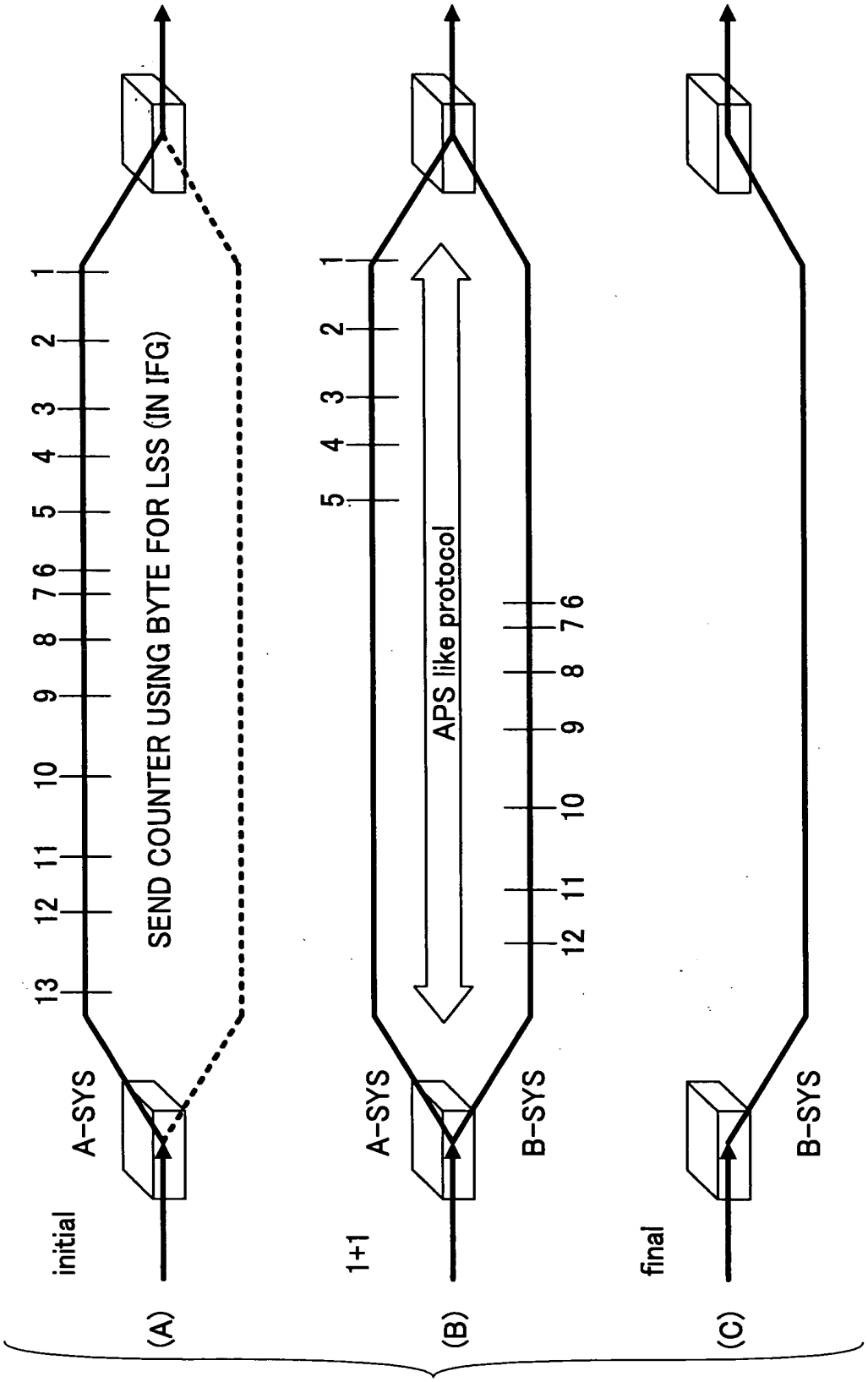

initial
A-SYS
SEND COUNTER USING BYTE FOR LSS (IN IFG)
1
2
3
4
5
6
7
8
9
10
11
12
13
(A)
1+1
A-SYS
B-SYS
APS like protocol
1
2
3
4
5
6
7
8
9
10
11
12
(B)
final
B-SYS
(C)

FIG.29

FIG.30

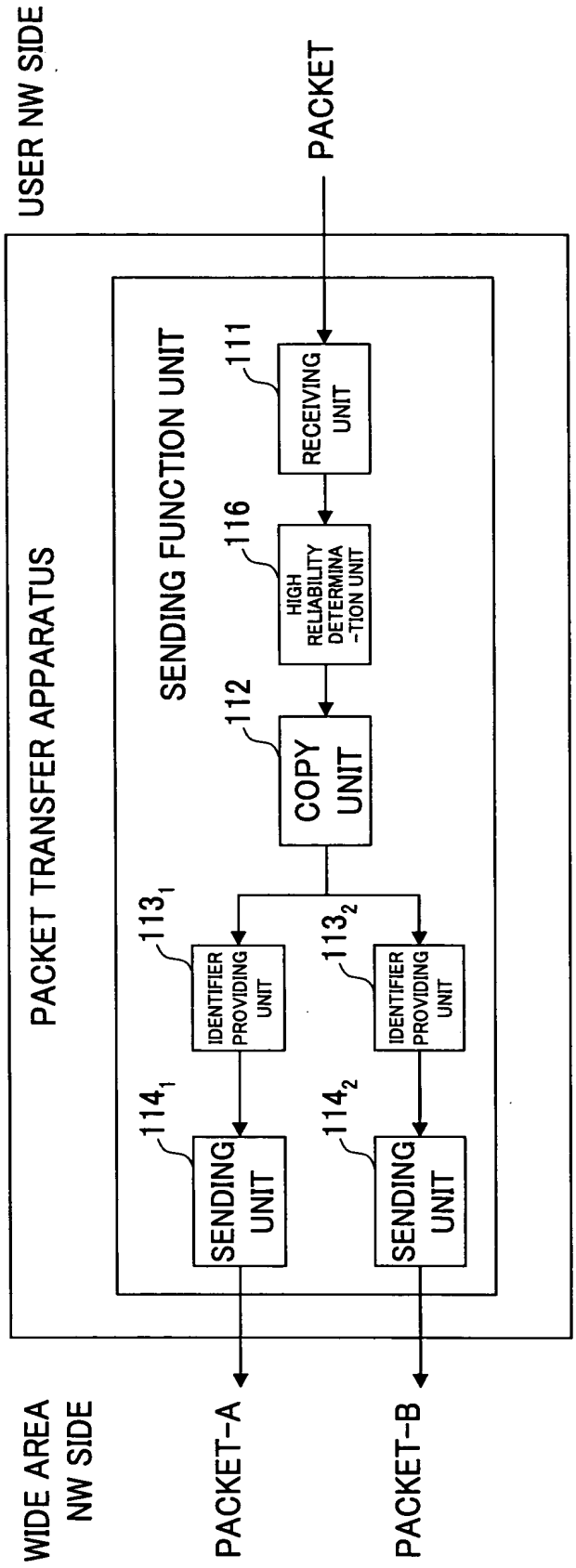
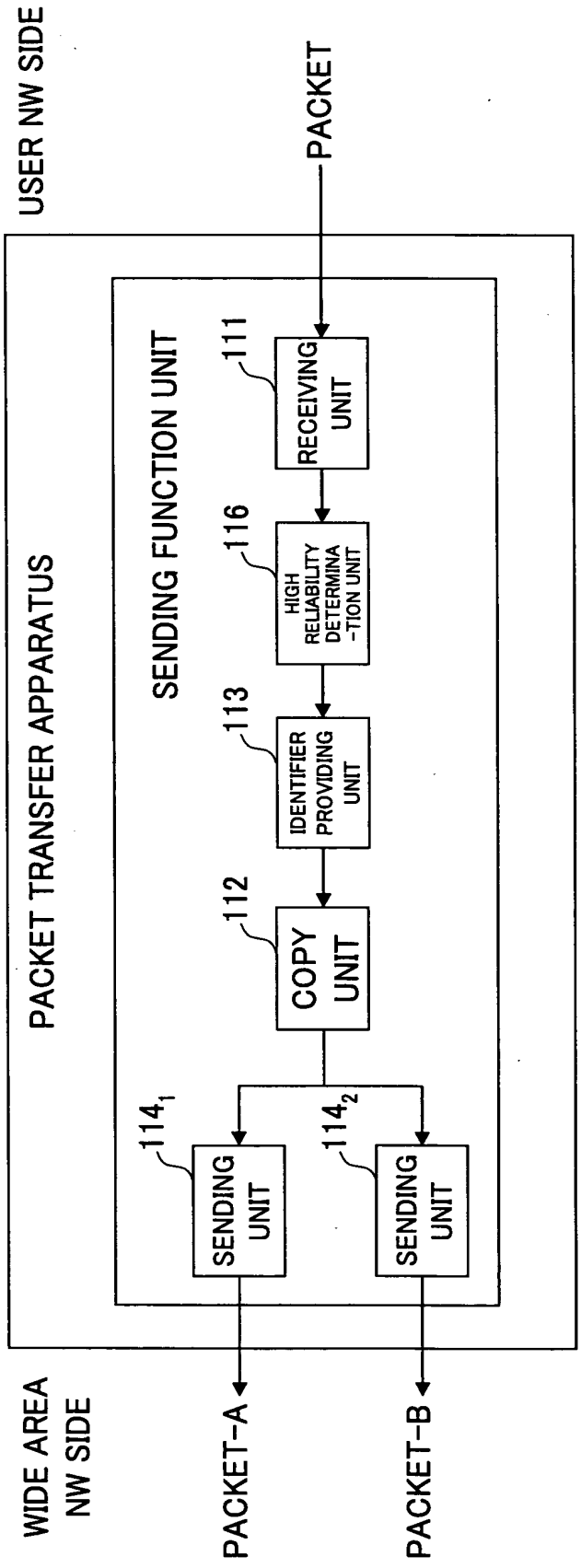

USER NW SIDE
PACKET
PACKET TRANSFER APPARATUS
SENDING FUNCTION UNIT
111
RECEIVING UNIT
116
HIGH RELIABILITY DETERMINA -TION UNIT
112
COPY UNIT
113$_1$
IDENTIFIER PROVIDING UNIT
113$_2$
IDENTIFIER PROVIDING UNIT
114$_1$
SENDING UNIT
114$_2$
SENDING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B

FIG.31


USER NW SIDE
PACKET
PACKET TRANSFER APPARATUS
SENDING FUNCTION UNIT
111
RECEIVING UNIT
116
HIGH RELIABILITY DETERMINA -TION UNIT
113
IDENTIFIER PROVIDING UNIT
112
COPY UNIT
114_1
SENDING UNIT
114_2
SENDING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B

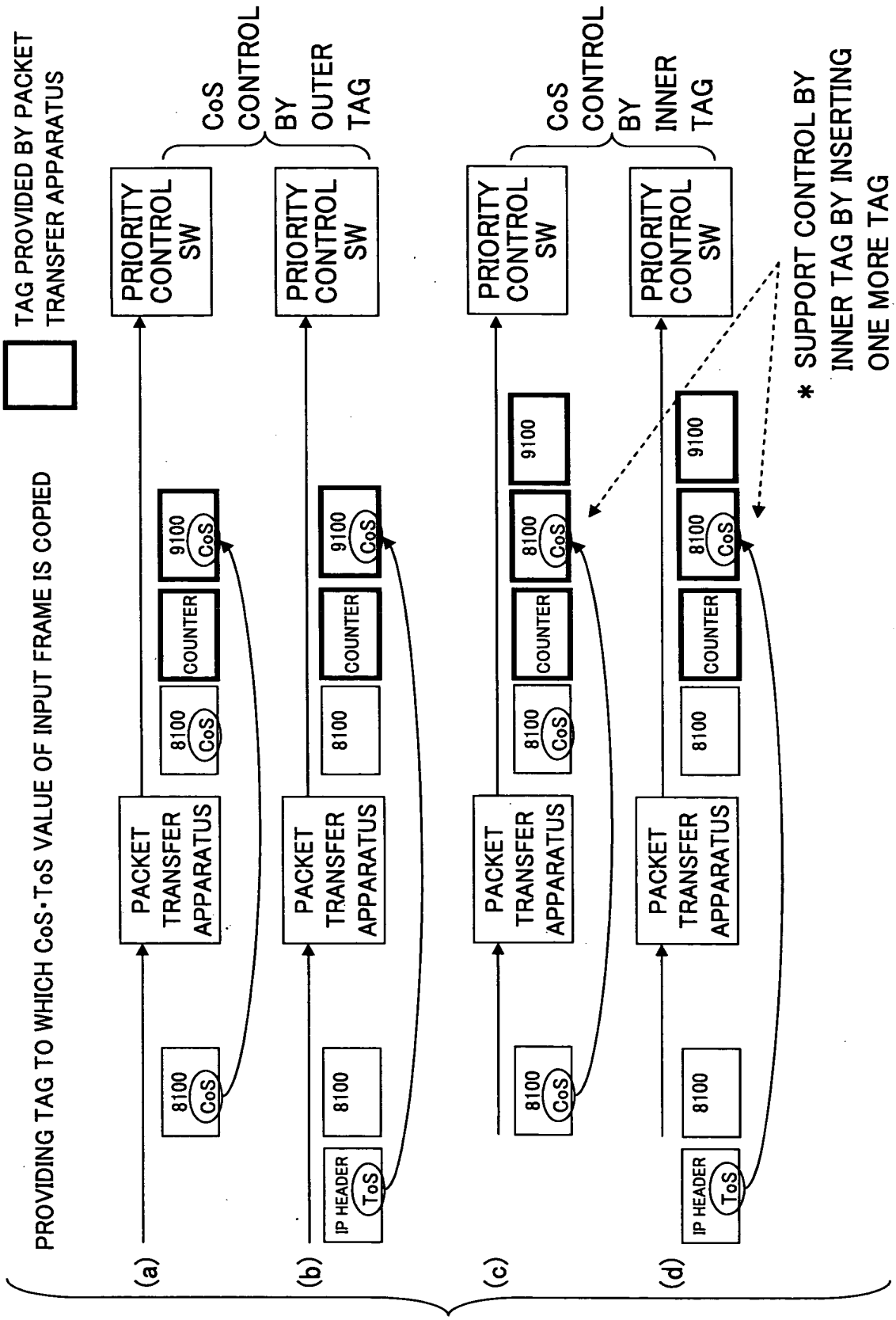

TAG PROVIDED BY PACKET TRANSFER APPARATUS
PROVIDING TAG TO WHICH CoS·ToS VALUE OF INPUT FRAME IS COPIED
CoS CONTROL BY OUTER TAG
CoS CONTROL BY INNER TAG
PRIORITY CONTROL SW
PACKET TRANSFER APPARATUS
8100
CoS
COUNTER
9100
IP HEADER
ToS
(a)
(b)
(c)
(d)
* SUPPORT CONTROL BY INNER TAG BY INSERTING ONE MORE TAG

FIG.32

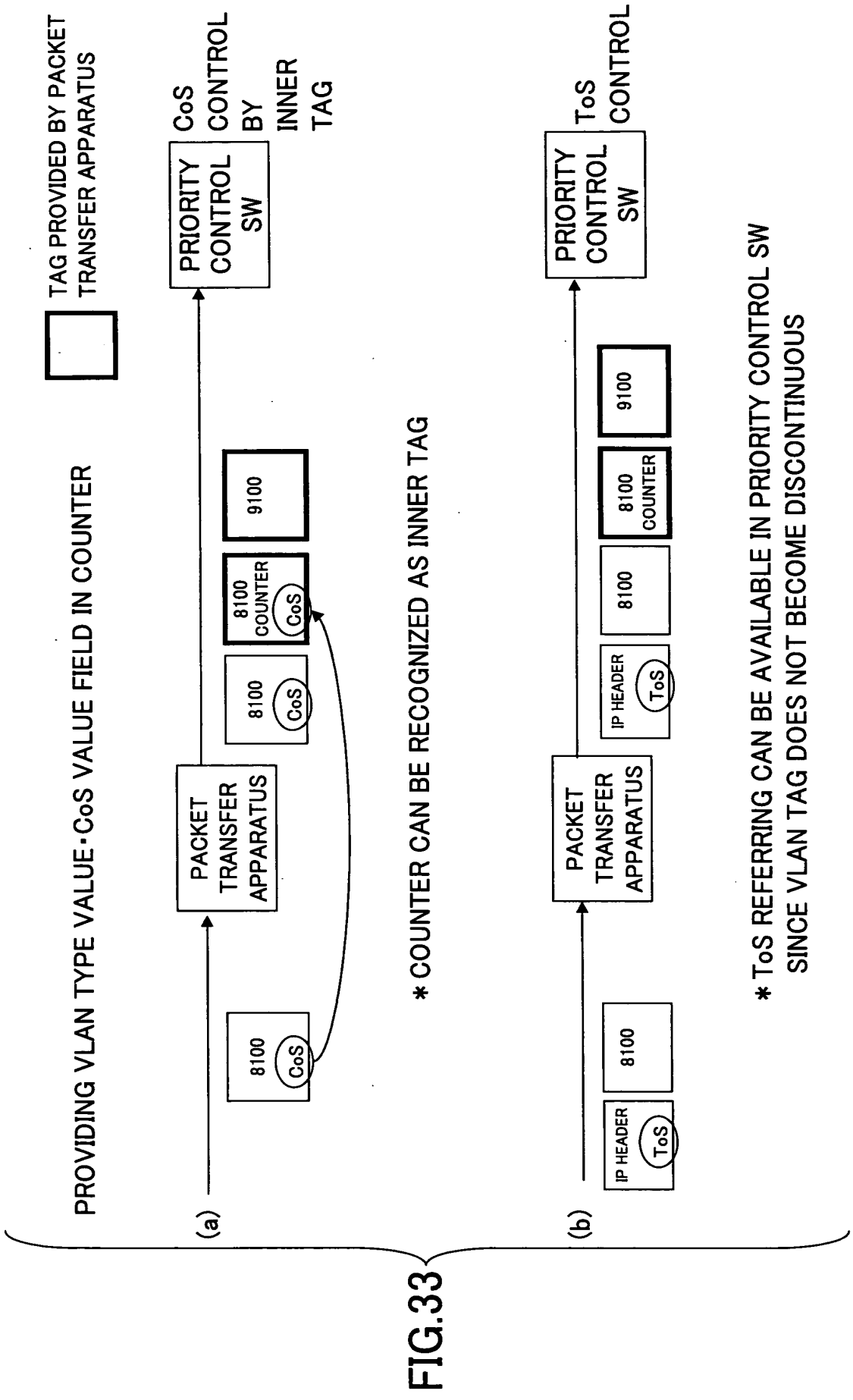

TAG PROVIDED BY PACKET TRANSFER APPARATUS
PROVIDING VLAN TYPE VALUE・CoS VALUE FIELD IN COUNTER
(a)
8100
CoS
PACKET TRANSFER APPARATUS
8100
CoS
8100 COUNTER
CoS
9100
PRIORITY CONTROL SW
CoS CONTROL BY INNER TAG
* COUNTER CAN BE RECOGNIZED AS INNER TAG
(b)
IP HEADER
ToS
8100
PACKET TRANSFER APPARATUS
IP HEADER
ToS
8100
8100 COUNTER
9100
PRIORITY CONTROL SW
ToS CONTROL
* ToS REFERRING CAN BE AVAILABLE IN PRIORITY CONTROL SW
SINCE VLAN TAG DOES NOT BECOME DISCONTINUOUS

FIG.33

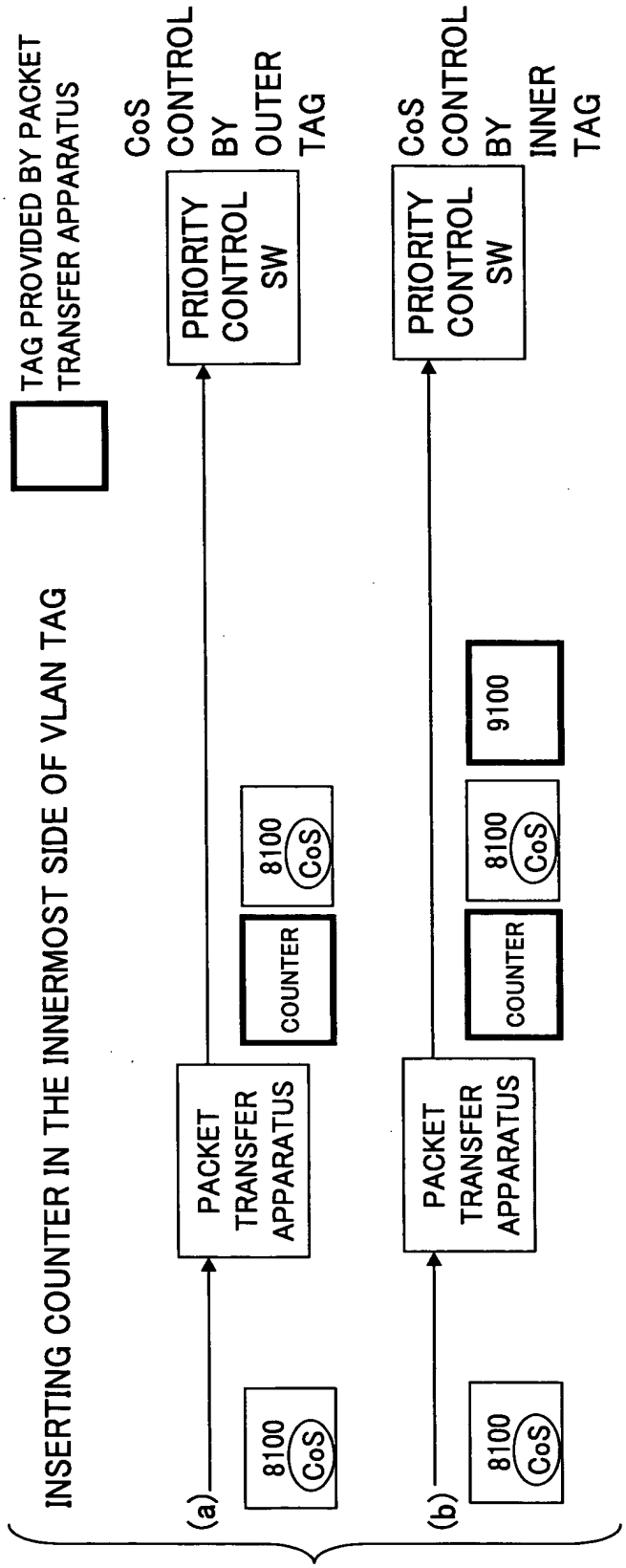

INSERTING COUNTER IN THE INNERMOST SIDE OF VLAN TAG
TAG PROVIDED BY PACKET TRANSFER APPARATUS
CoS CONTROL BY OUTER TAG
CoS CONTROL BY INNER TAG
PRIORITY CONTROL SW
PRIORITY CONTROL SW
PACKET TRANSFER APPARATUS
PACKET TRANSFER APPARATUS
COUNTER
COUNTER
8100 CoS
8100 CoS
8100 CoS
8100 CoS
9100
(a)
(b)

FIG.34

FIG.35

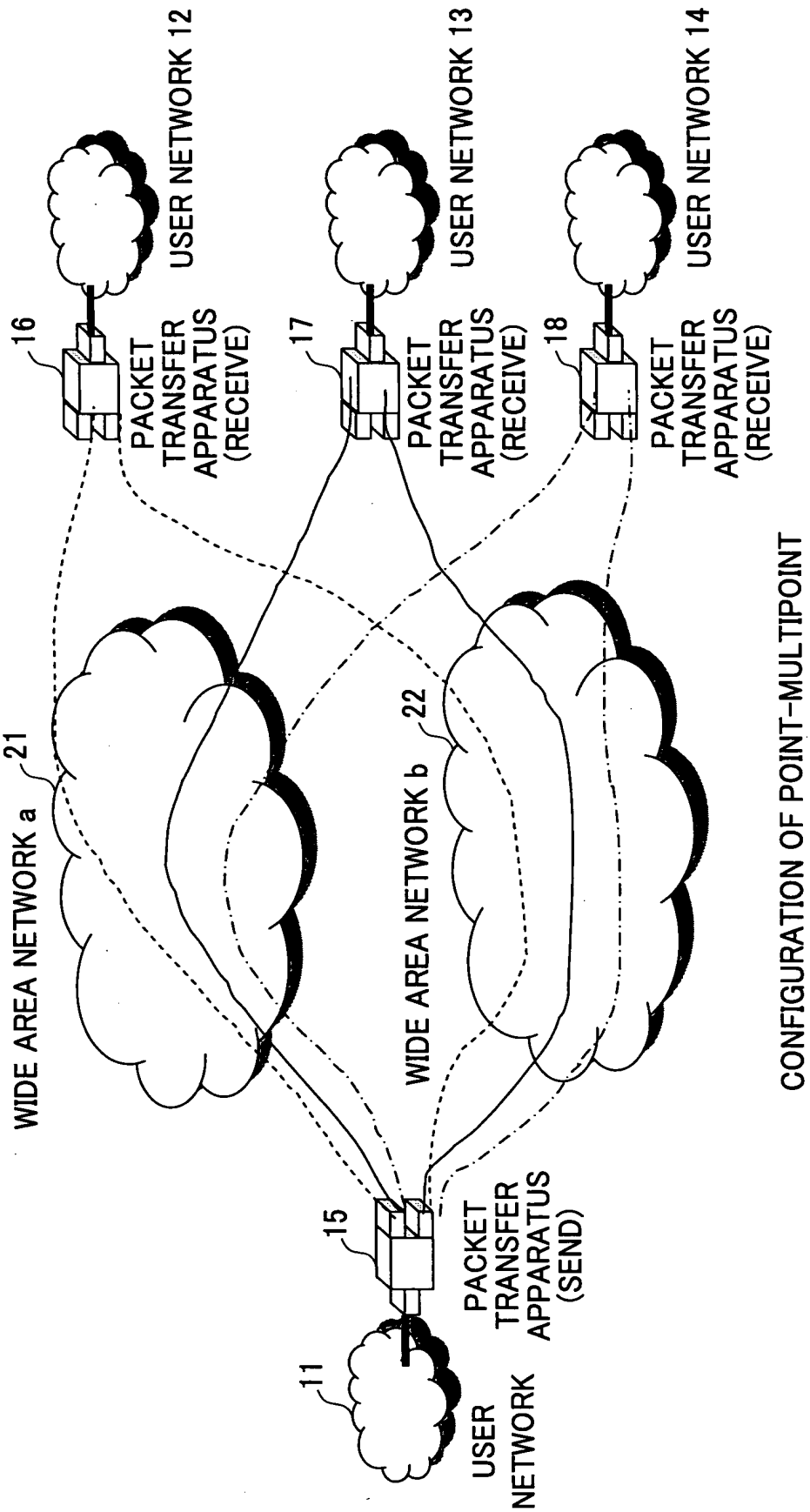
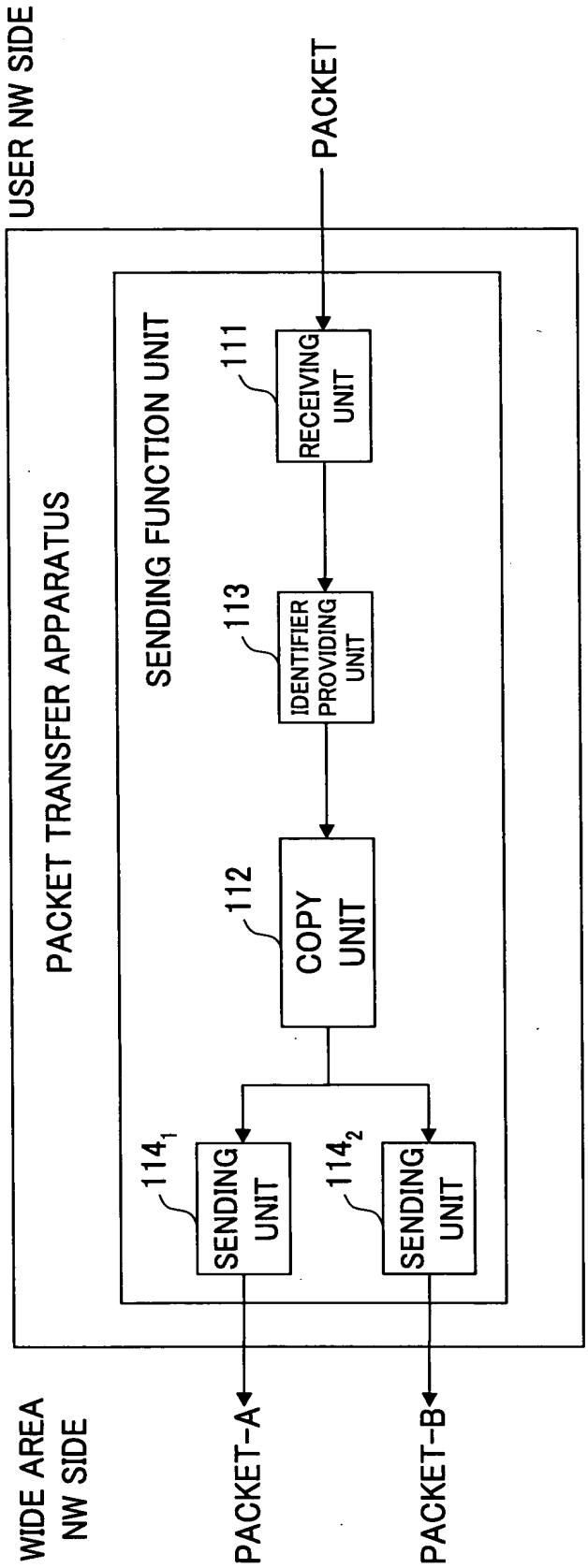

USER NETWORK 12
USER NETWORK 13
USER NETWORK 14
16
17
18
PACKET TRANSFER APPARATUS (RECEIVE)
PACKET TRANSFER APPARATUS (RECEIVE)
PACKET TRANSFER APPARATUS (RECEIVE)
WIDE AREA NETWORK a
21
WIDE AREA NETWORK b
22
15
PACKET TRANSFER APPARATUS (SEND)
11
USER NETWORK
CONFIGURATION OF POINT-MULTIPOINT

FIG.36


USER NW SIDE
PACKET
PACKET TRANSFER APPARATUS
SENDING FUNCTION UNIT
111
RECEIVING UNIT
113
IDENTIFIER PROVIDING UNIT
112
COPY UNIT
114$_1$
SENDING UNIT
114$_2$
SENDING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B

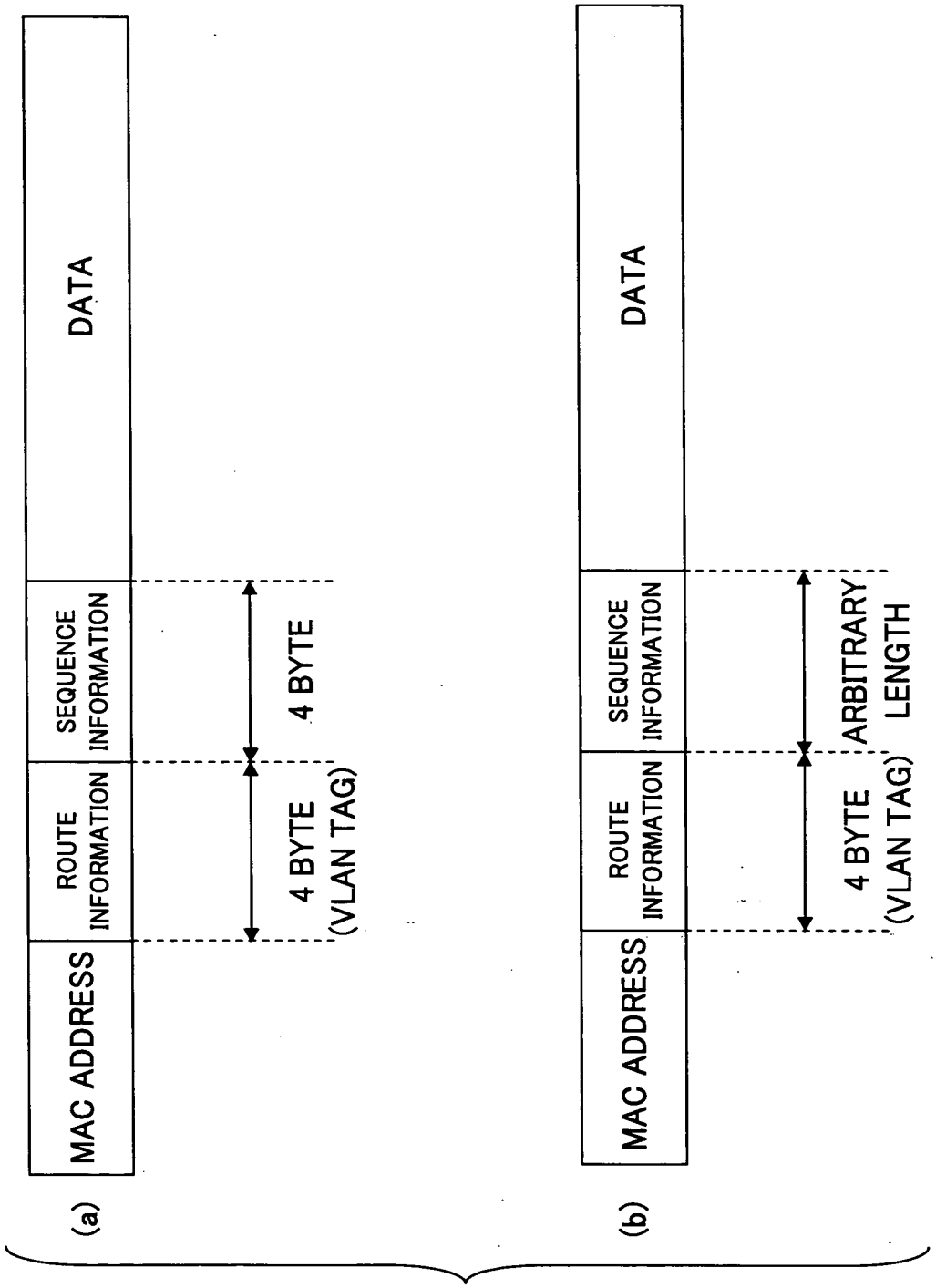

(a)
MAC ADDRESS
ROUTE INFORMATION
SEQUENCE INFORMATION
DATA
4 BYTE (VLAN TAG)
4 BYTE
(b)
MAC ADDRESS
ROUTE INFORMATION
SEQUENCE INFORMATION
DATA
4 BYTE (VLAN TAG)
ARBITRARY LENGTH

FIG.37

FIG.38

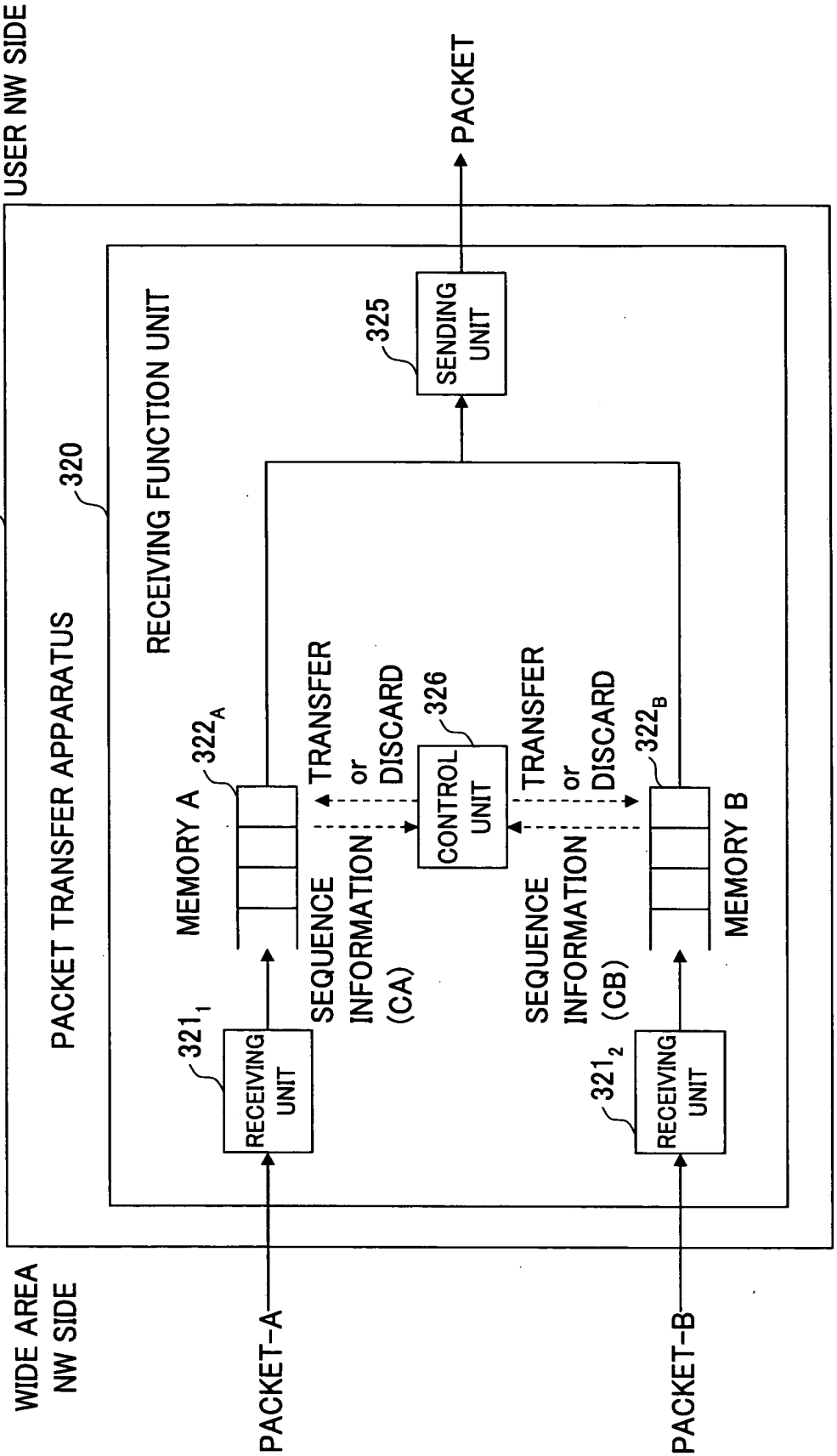

USER NW SIDE
PACKET
300
320
PACKET TRANSFER APPARATUS
RECEIVING FUNCTION UNIT
325
SENDING UNIT
MEMORY A
322A
TRANSFER
or
DISCARD
326
CONTROL UNIT
TRANSFER
or
DISCARD
322B
MEMORY B
SEQUENCE INFORMATION (CA)
SEQUENCE INFORMATION (CB)
321 1
RECEIVING UNIT
321 2
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B

FIG.39

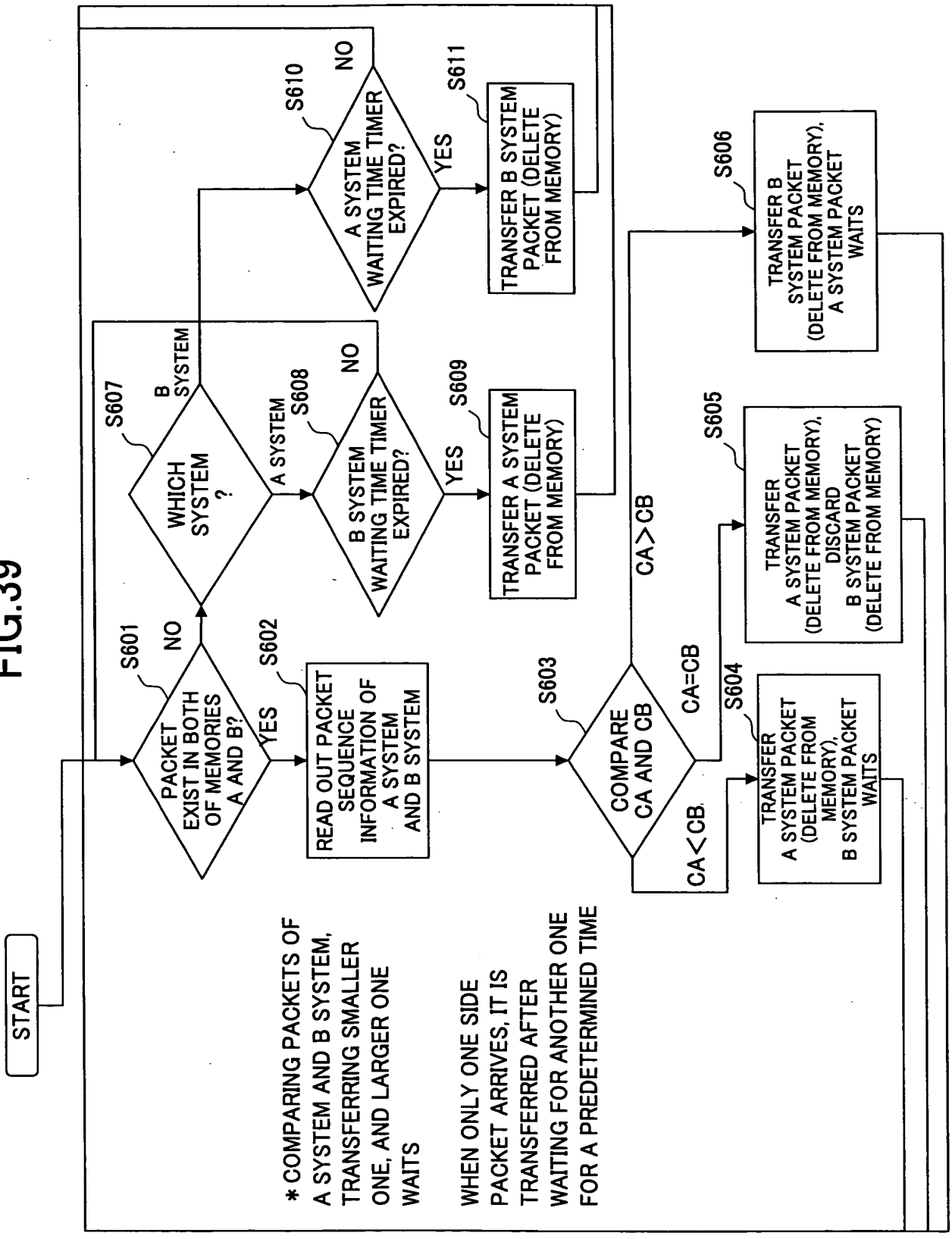

START
S601
PACKET EXIST IN BOTH OF MEMORIES A AND B?
NO
YES
S602
READ OUT PACKET SEQUENCE INFORMATION OF A SYSTEM AND B SYSTEM
S603
COMPARE CA AND CB
CA<CB
CA=CB
CA>CB
S604
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY), B SYSTEM PACKET WAITS
S605
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY), DISCARD B SYSTEM PACKET (DELETE FROM MEMORY)
S606
TRANSFER B SYSTEM PACKET (DELETE FROM MEMORY), A SYSTEM PACKET WAITS
S607
WHICH SYSTEM ?
A SYSTEM
B SYSTEM
S608
B SYSTEM WAITING TIME TIMER EXPIRED?
NO
YES
S609
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY)
S610
A SYSTEM WAITING TIME TIMER EXPIRED?
NO
YES
S611
TRANSFER B SYSTEM PACKET (DELETE FROM MEMORY)
* COMPARING PACKETS OF A SYSTEM AND B SYSTEM, TRANSFERRING SMALLER ONE, AND LARGER ONE WAITS
WHEN ONLY ONE SIDE PACKET ARRIVES, IT IS TRANSFERRED AFTER WAITING FOR ANOTHER ONE FOR A PREDETERMINED TIME

FIG.40

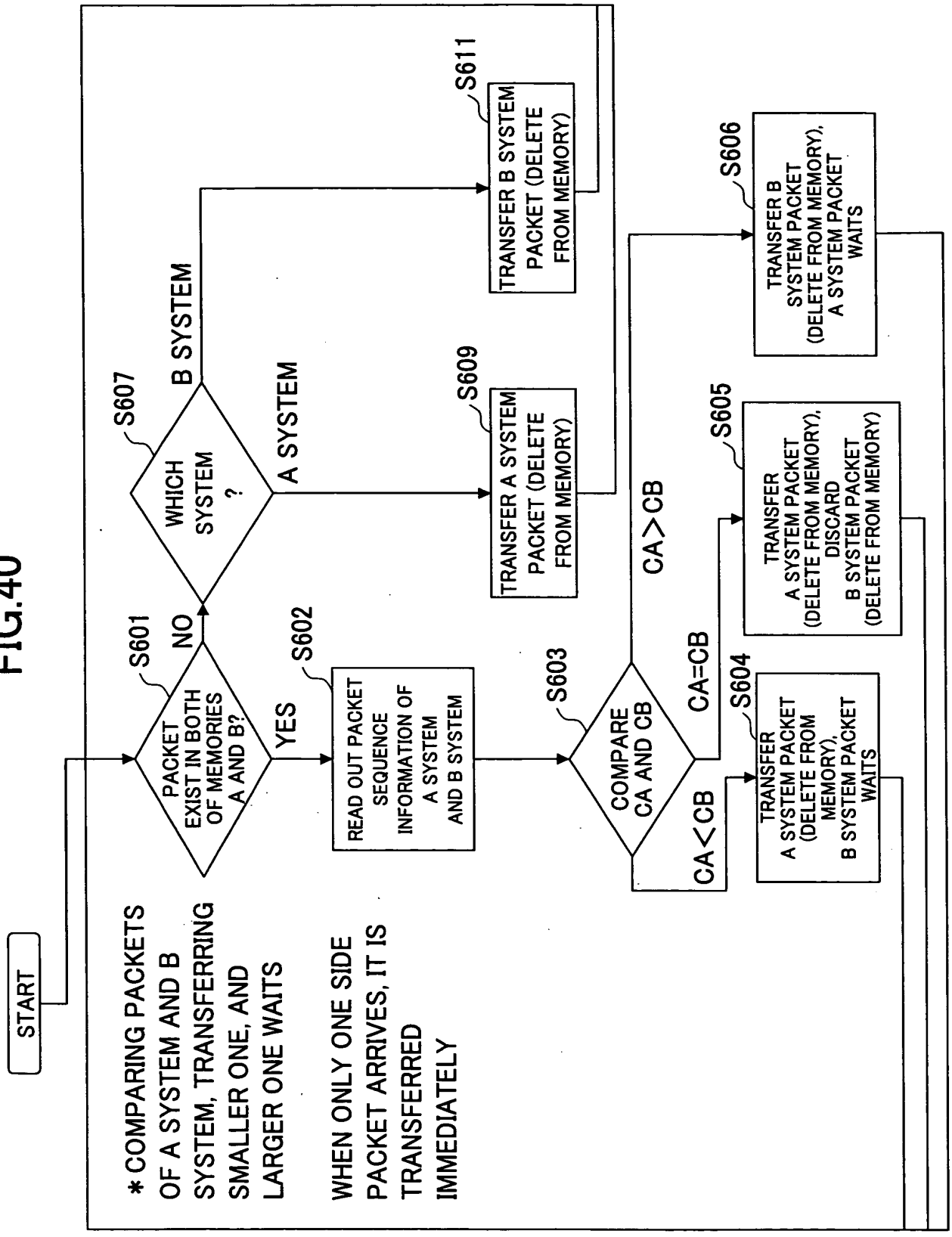

START
PACKET EXIST IN BOTH OF MEMORIES A AND B?
S601
NO
YES
S602
READ OUT PACKET SEQUENCE INFORMATION OF A SYSTEM AND B SYSTEM
S603
COMPARE CA AND CB
CA<CB
CA=CB
CA>CB
S604
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY), B SYSTEM PACKET WAITS
S605
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY), DISCARD B SYSTEM PACKET (DELETE FROM MEMORY)
S606
TRANSFER B SYSTEM PACKET (DELETE FROM MEMORY), A SYSTEM PACKET WAITS
S607
WHICH SYSTEM ?
A SYSTEM
B SYSTEM
S609
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY)
S611
TRANSFER B SYSTEM PACKET (DELETE FROM MEMORY)
* COMPARING PACKETS OF A SYSTEM AND B SYSTEM, TRANSFERRING SMALLER ONE, AND LARGER ONE WAITS
WHEN ONLY ONE SIDE PACKET ARRIVES, IT IS TRANSFERRED IMMEDIATELY

FIG.41

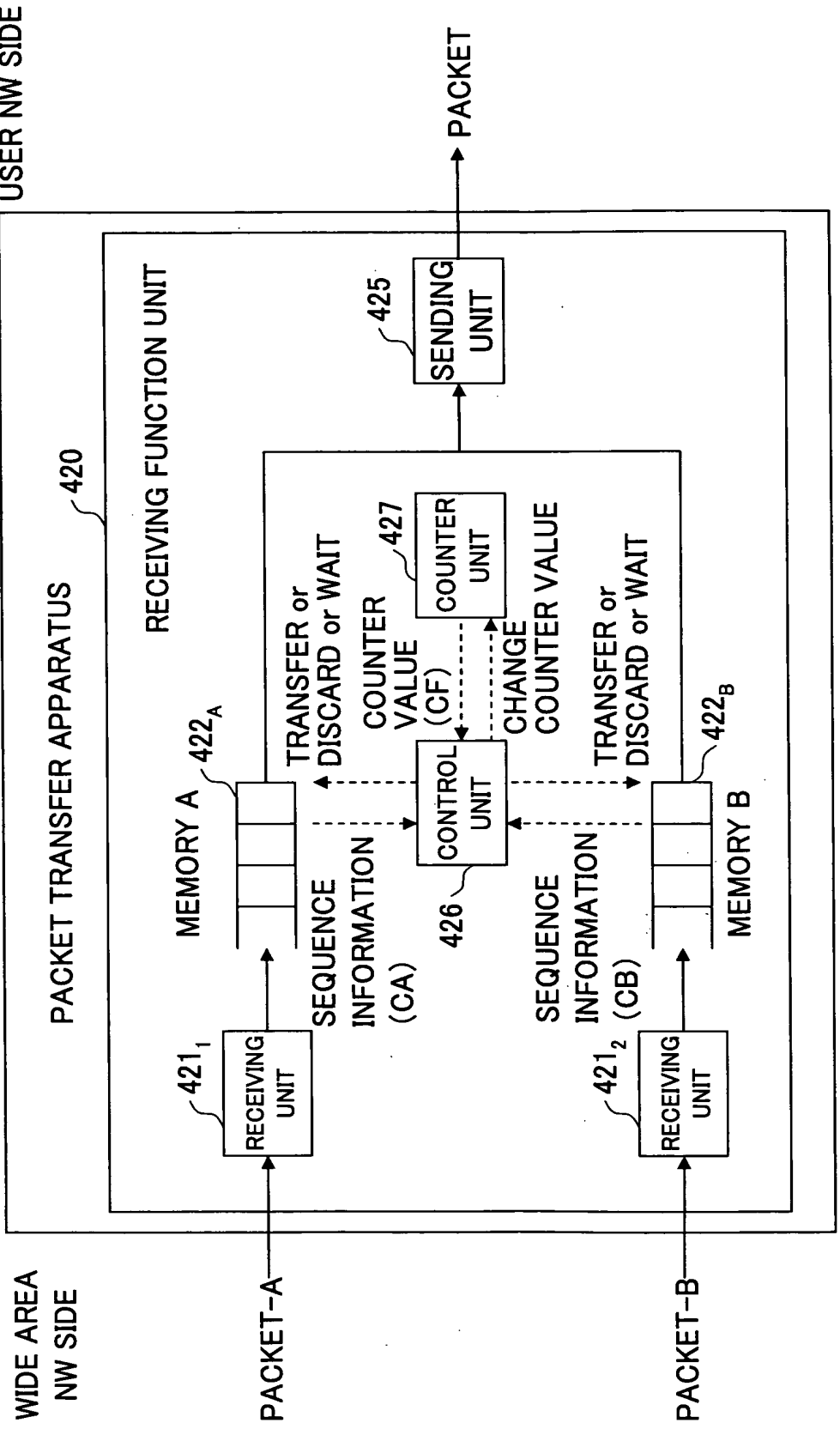
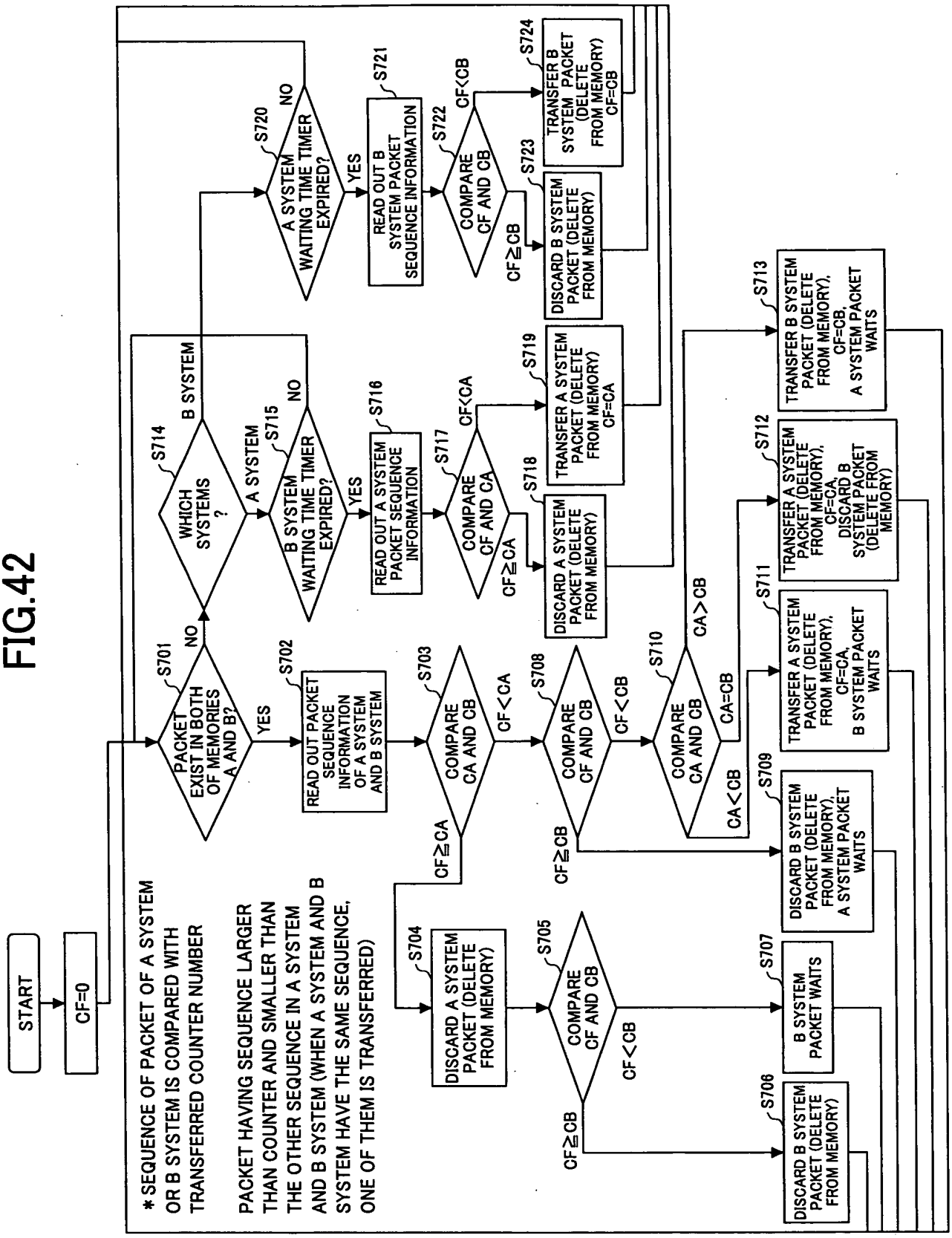

USER NW SIDE
PACKET
400
420
PACKET TRANSFER APPARATUS
RECEIVING FUNCTION UNIT
425
SENDING UNIT
427
COUNTER UNIT
TRANSFER or DISCARD or WAIT
COUNTER VALUE (CF)
CHANGE COUNTER VALUE
TRANSFER or DISCARD or WAIT
422A
MEMORY A
CONTROL UNIT
426
422B
MEMORY B
SEQUENCE INFORMATION (CA)
SEQUENCE INFORMATION (CB)
4211
RECEIVING UNIT
4212
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B

FIG.42


START
CF=0
* SEQUENCE OF PACKET OF A SYSTEM OR B SYSTEM IS COMPARED WITH TRANSFERRED COUNTER NUMBER
PACKET HAVING SEQUENCE LARGER THAN COUNTER AND SMALLER THAN THE OTHER SEQUENCE IN A SYSTEM AND B SYSTEM (WHEN A SYSTEM AND B SYSTEM HAVE THE SAME SEQUENCE, ONE OF THEM IS TRANSFERRED)
S701
PACKET EXIST IN BOTH OF MEMORIES A AND B?
NO
YES
S702
READ OUT PACKET SEQUENCE INFORMATION OF A SYSTEM AND B SYSTEM
S703
COMPARE CA AND CB
CF<CA
CF≧CA
S704
DISCARD A SYSTEM PACKET (DELETE FROM MEMORY)
S705
COMPARE CF AND CB
CF<CB
CF≧CB
S706
DISCARD B SYSTEM PACKET (DELETE FROM MEMORY)
S707
B SYSTEM PACKET WAITS
S708
COMPARE CF AND CB
CF<CB
CF≧CB
S709
DISCARD B SYSTEM PACKET (DELETE FROM MEMORY), A SYSTEM PACKET WAITS
S710
COMPARE CA AND CB
CA<CB
CA=CB
CA>CB
S711
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY), CF=CA, B SYSTEM PACKET WAITS
S712
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY), CF=CA, DISCARD B SYSTEM PACKET (DELETE FROM MEMORY)
S713
TRANSFER B SYSTEM PACKET (DELETE FROM MEMORY), CF=CB, A SYSTEM PACKET WAITS
S714
WHICH SYSTEMS ?
A SYSTEM
B SYSTEM
S715
B SYSTEM WAITING TIME TIMER EXPIRED?
NO
YES
S716
READ OUT A SYSTEM PACKET SEQUENCE INFORMATION
S717
COMPARE CF AND CA
CF<CA
CF≧CA
S718
DISCARD A SYSTEM PACKET (DELETE FROM MEMORY)
S719
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY) CF=CA
S720
A SYSTEM WAITING TIME TIMER EXPIRED?
NO
YES
S721
READ OUT B SYSTEM PACKET SEQUENCE INFORMATION
S722
COMPARE CF AND CB
CF<CB
CF≧CB
S723
DISCARD B SYSTEM PACKET (DELETE FROM MEMORY)
S724
TRANSFER B SYSTEM PACKET (DELETE FROM MEMORY) CF=CB

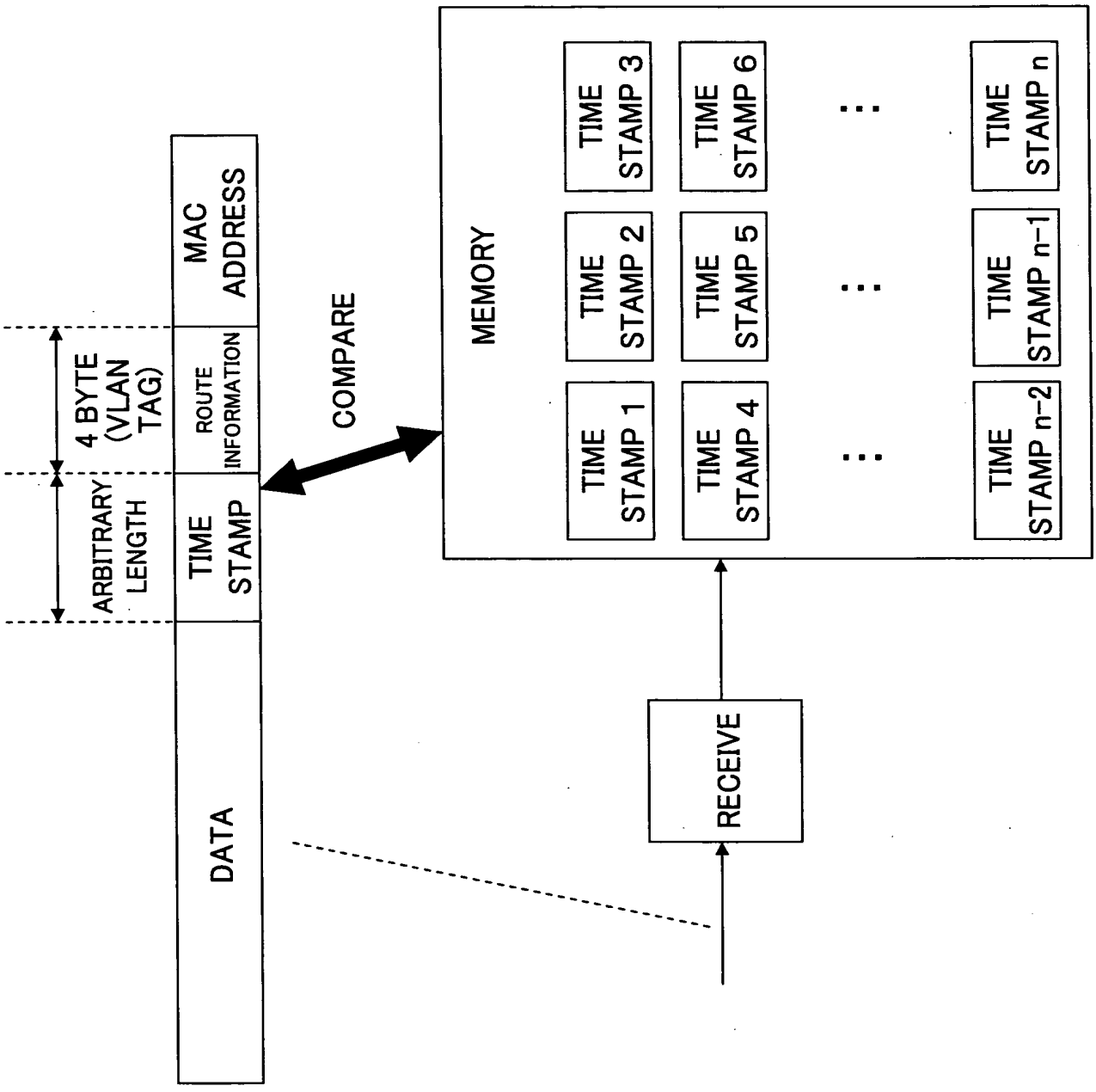

MAC ADDRESS
ROUTE INFORMATION
TIME STAMP
DATA
4 BYTE (VLAN TAG)
ARBITRARY LENGTH
COMPARE
MEMORY
TIME STAMP 1
TIME STAMP 2
TIME STAMP 3
TIME STAMP 4
TIME STAMP 5
TIME STAMP 6
TIME STAMP n-2
TIME STAMP n-1
TIME STAMP n
RECEIVE

FIG.43

FIG.44

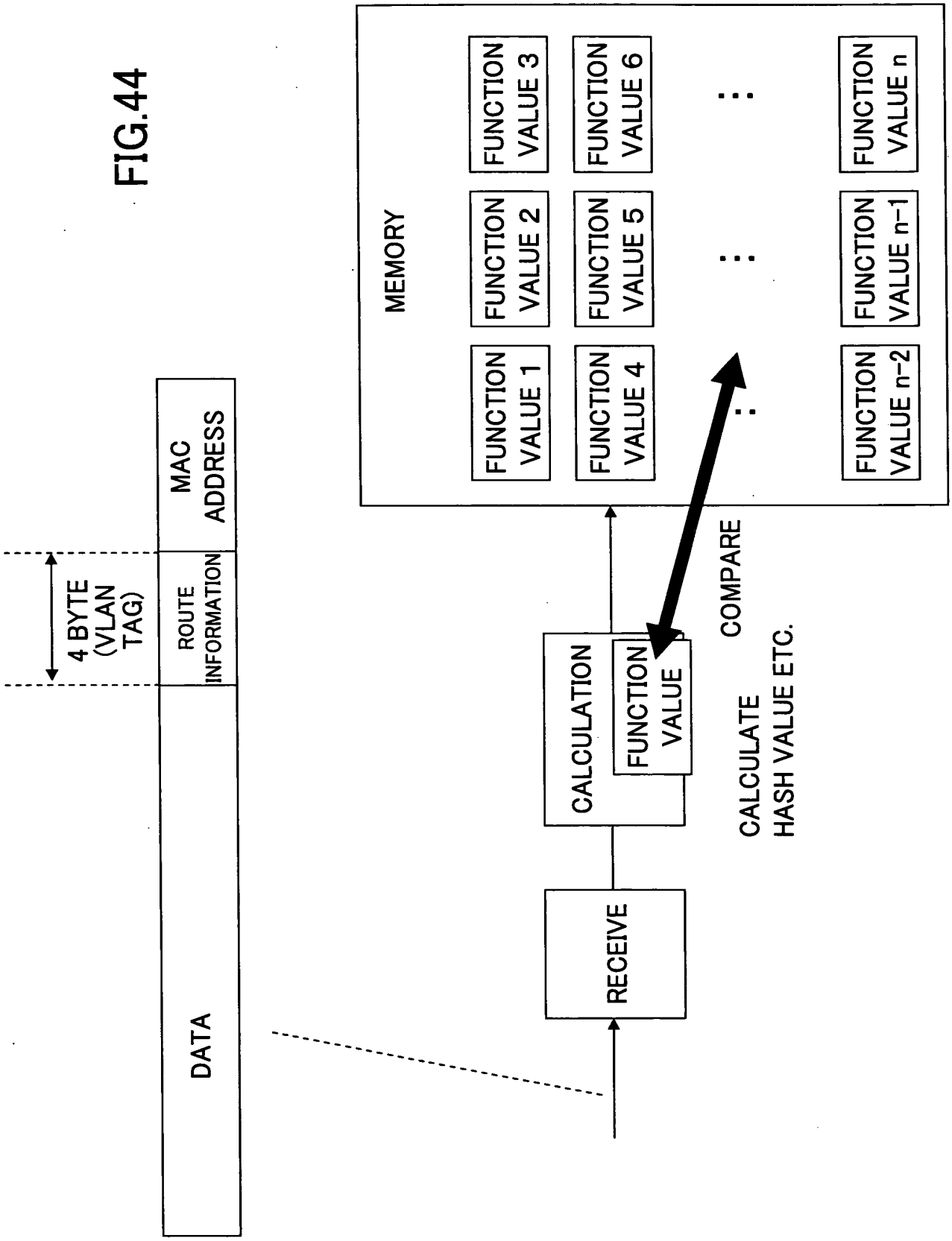
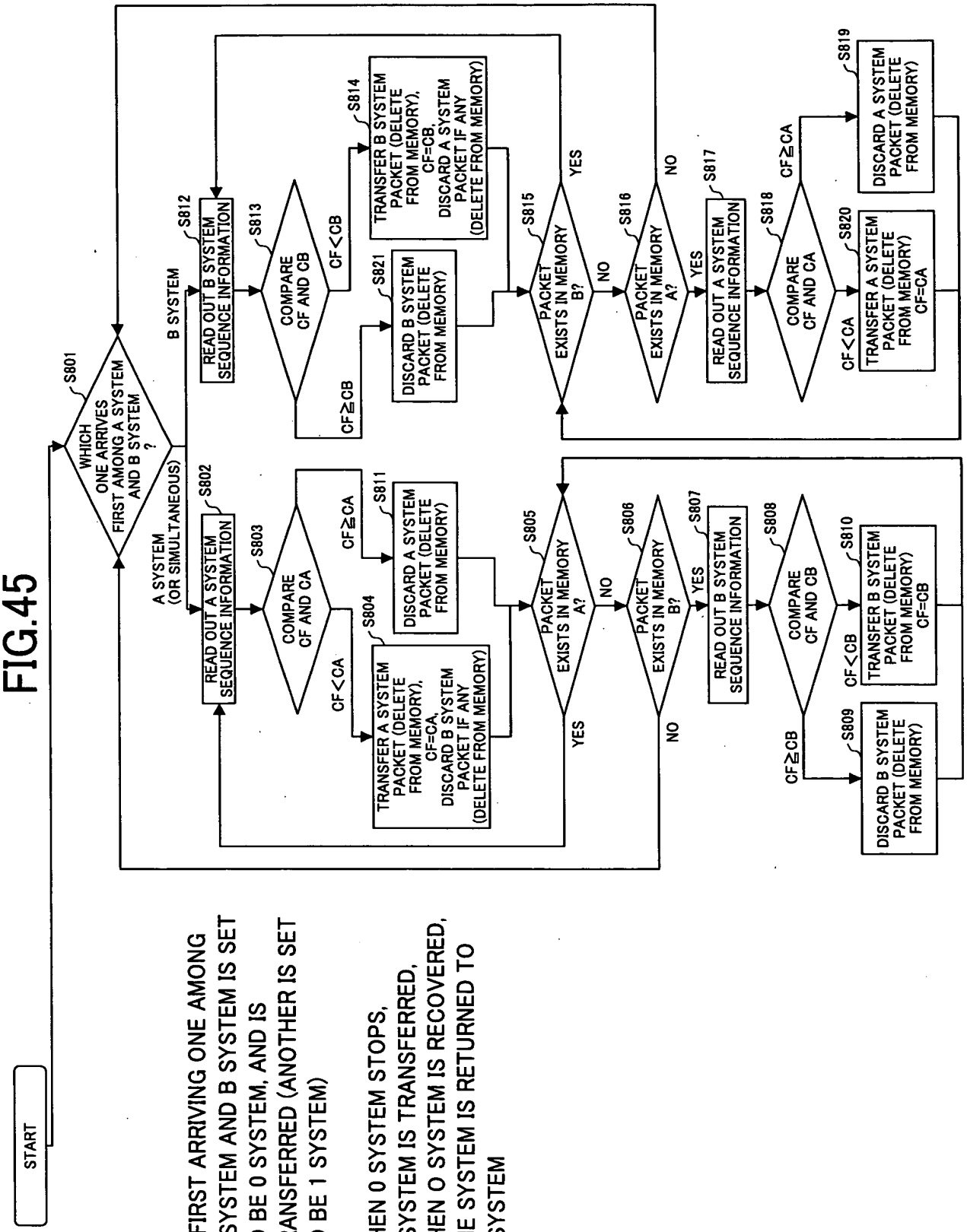

MEMORY
FUNCTION VALUE 1
FUNCTION VALUE 2
FUNCTION VALUE 3
FUNCTION VALUE 4
FUNCTION VALUE 5
FUNCTION VALUE 6
FUNCTION VALUE n-2
FUNCTION VALUE n-1
FUNCTION VALUE n
MAC ADDRESS
ROUTE INFORMATION
4 BYTE (VLAN TAG)
DATA
RECEIVE
CALCULATION
FUNCTION VALUE
CALCULATE HASH VALUE ETC.
COMPARE

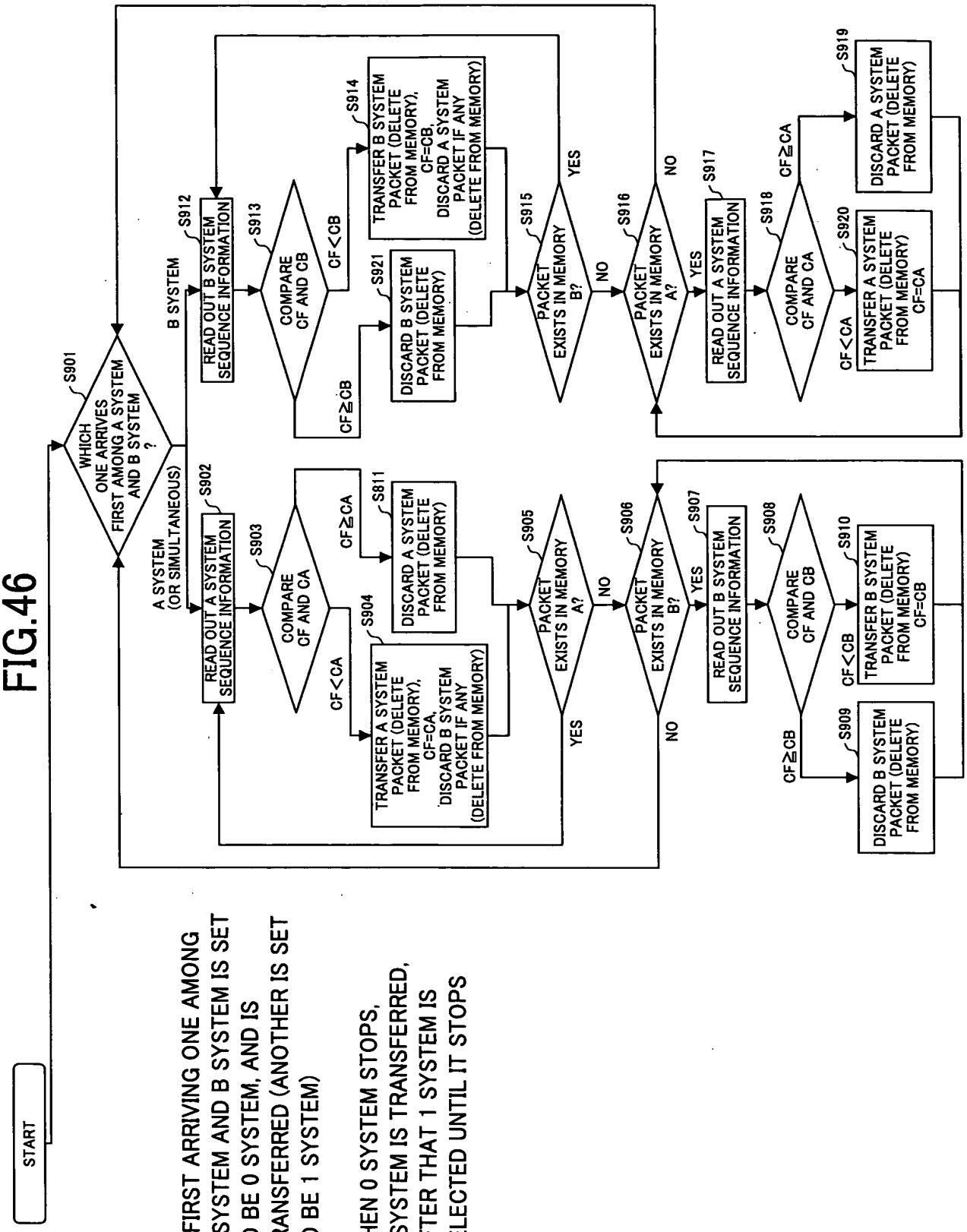
FIG.45



* FIRST ARRIVING ONE AMONG A SYSTEM AND B SYSTEM IS SET TO BE 0 SYSTEM, AND IS TRANSFERRED (ANOTHER IS SET TO BE 1 SYSTEM)

WHEN 0 SYSTEM STOPS, 1 SYSTEM IS TRANSFERRED, WHEN O SYSTEM IS RECOVERED, THE SYSTEM IS RETURNED TO 0 SYSTEM

FIG.46



* FIRST ARRIVING ONE AMONG A SYSTEM AND B SYSTEM IS SET TO BE 0 SYSTEM, AND IS TRANSFERRED (ANOTHER IS SET TO BE 1 SYSTEM)

WHEN 0 SYSTEM STOPS, 1 SYSTEM IS TRANSFERRED, AFTER THAT 1 SYSTEM IS SELECTED UNTIL IT STOPS

FIG.47

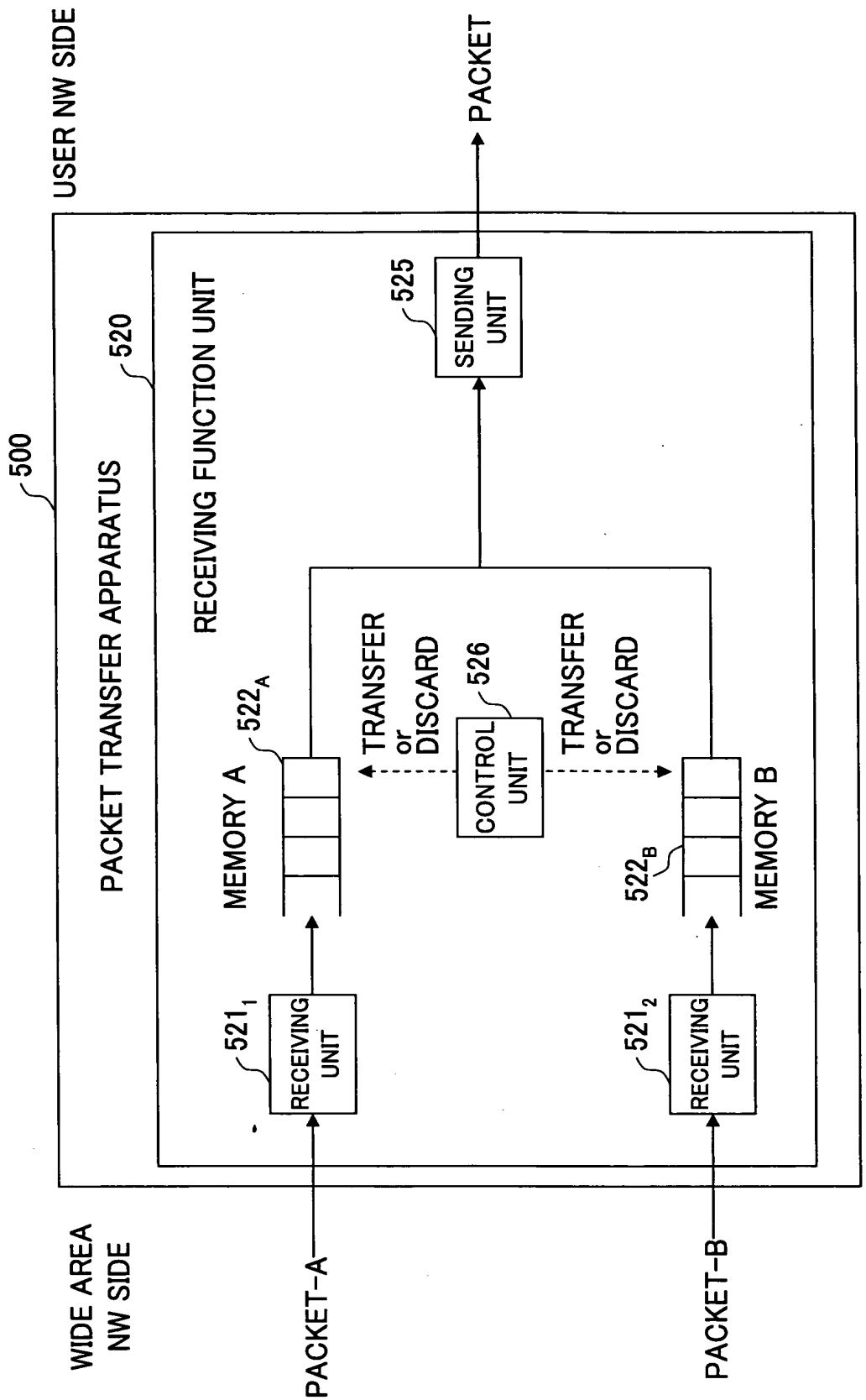

USER NW SIDE
PACKET
500
PACKET TRANSFER APPARATUS
520
RECEIVING FUNCTION UNIT
525
SENDING UNIT
TRANSFER or DISCARD
526
CONTROL UNIT
TRANSFER or DISCARD
MEMORY A
522A
MEMORY B
522B
521 1
RECEIVING UNIT
521 2
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B

FIG.48

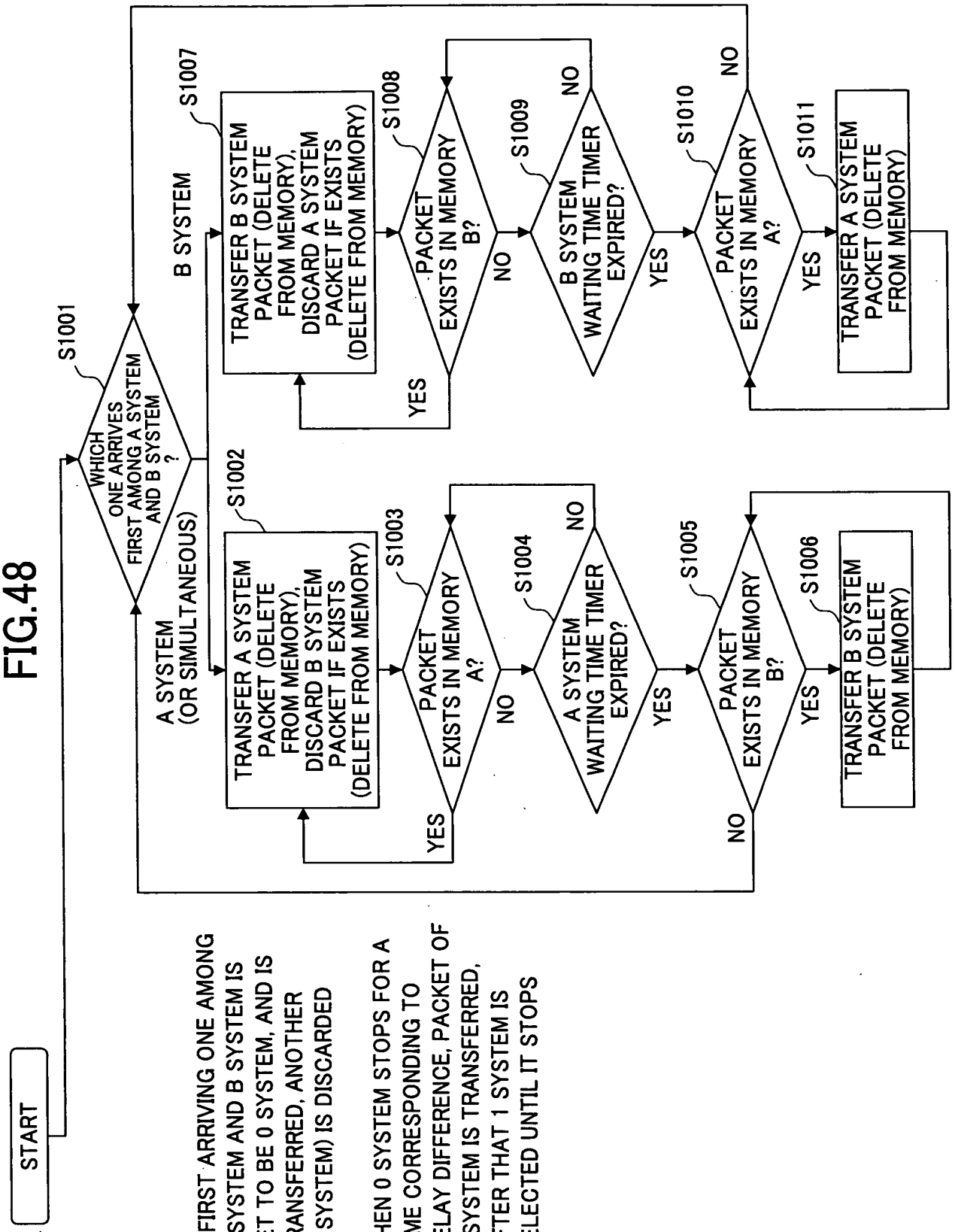
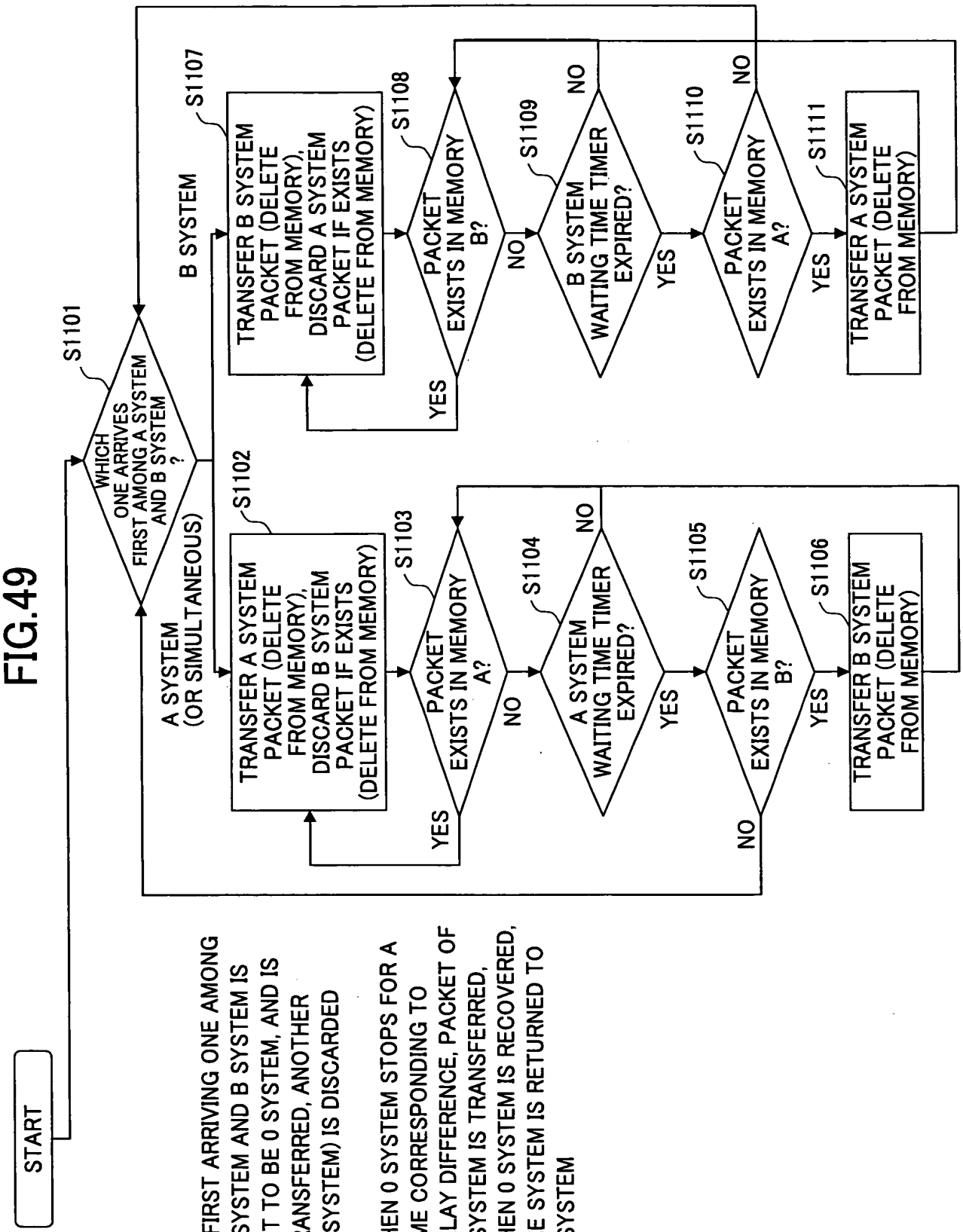

START
S1001
WHICH ONE ARRIVES FIRST AMONG A SYSTEM AND B SYSTEM ?
A SYSTEM (OR SIMULTANEOUS)
S1002
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY), DISCARD B SYSTEM PACKET IF EXISTS (DELETE FROM MEMORY)
S1003
PACKET EXISTS IN MEMORY A?
YES
NO
S1004
A SYSTEM WAITING TIME TIMER EXPIRED?
NO
YES
S1005
PACKET EXISTS IN MEMORY B?
NO
YES
S1006
TRANSFER B SYSTEM PACKET (DELETE FROM MEMORY)
B SYSTEM
S1007
TRANSFER B SYSTEM PACKET (DELETE FROM MEMORY), DISCARD A SYSTEM PACKET IF EXISTS (DELETE FROM MEMORY)
S1008
PACKET EXISTS IN MEMORY B?
YES
NO
S1009
B SYSTEM WAITING TIME TIMER EXPIRED?
NO
YES
S1010
PACKET EXISTS IN MEMORY A?
NO
YES
S1011
TRANSFER A SYSTEM PACKET (DELETE FROM MEMORY)
* FIRST ARRIVING ONE AMONG A SYSTEM AND B SYSTEM IS SET TO BE 0 SYSTEM, AND IS TRANSFERRED, ANOTHER (1 SYSTEM) IS DISCARDED
WHEN 0 SYSTEM STOPS FOR A TIME CORRESPONDING TO DELAY DIFFERENCE, PACKET OF 1 SYSTEM IS TRANSFERRED, AFTER THAT 1 SYSTEM IS SELECTED UNTIL IT STOPS

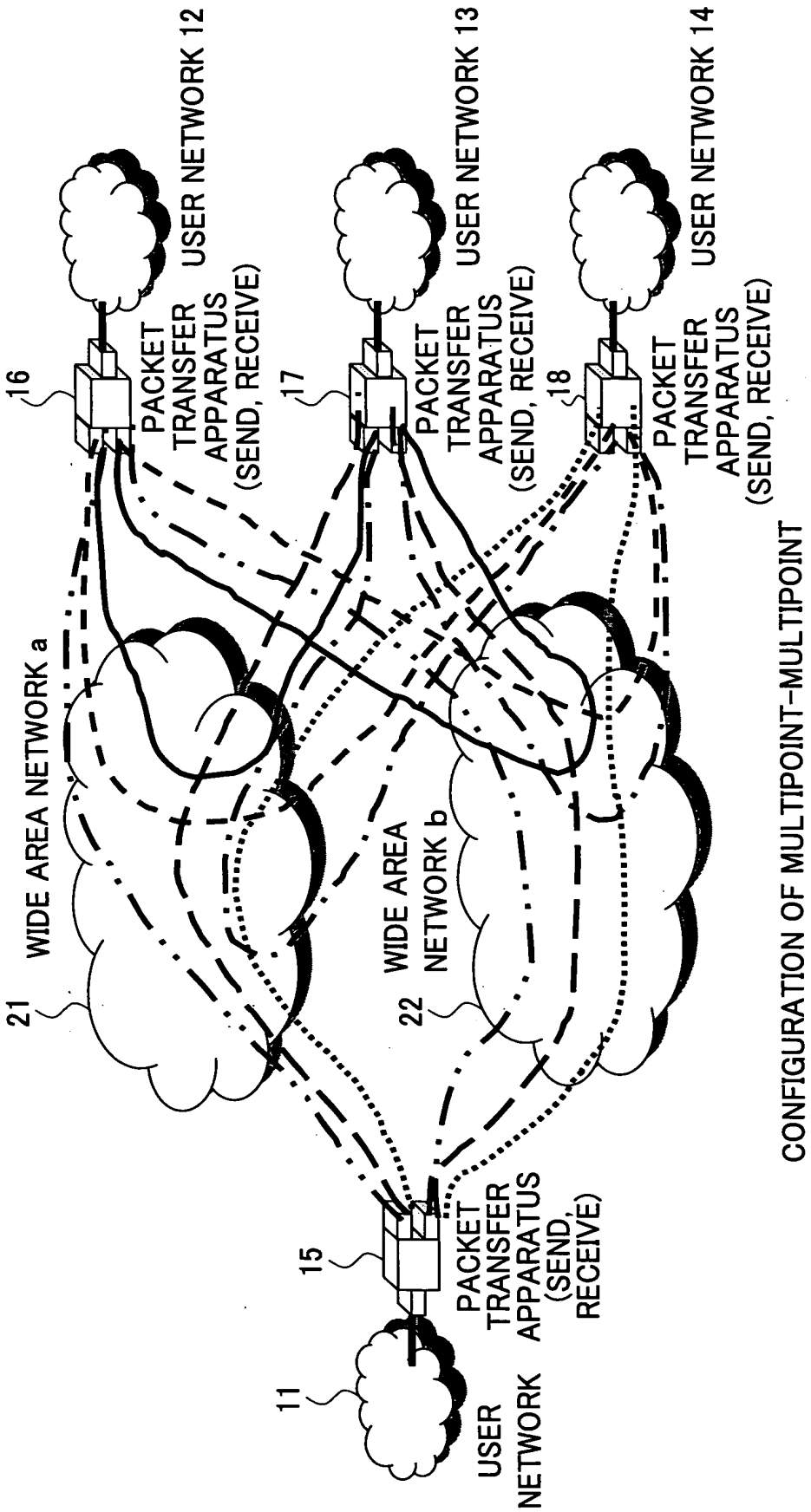
FIG.49



* FIRST ARRIVING ONE AMONG A SYSTEM AND B SYSTEM IS SET TO BE 0 SYSTEM, AND IS TRANSFERRED, ANOTHER (1 SYSTEM) IS DISCARDED

WHEN 0 SYSTEM STOPS FOR A TIME CORRESPONDING TO DELAY DIFFERENCE, PACKET OF 1 SYSTEM IS TRANSFERRED, WHEN 0 SYSTEM IS RECOVERED, THE SYSTEM IS RETURNED TO 0 SYSTEM

FIG.50


USER NETWORK 12
USER NETWORK 13
USER NETWORK 14
16
17
18
PACKET TRANSFER APPARATUS (SEND, RECEIVE)
PACKET TRANSFER APPARATUS (SEND, RECEIVE)
PACKET TRANSFER APPARATUS (SEND, RECEIVE)
WIDE AREA NETWORK a
WIDE AREA NETWORK b
21
22
15
PACKET TRANSFER APPARATUS (SEND, RECEIVE)
11
USER NETWORK
CONFIGURATION OF MULTIPOINT-MULTIPOINT

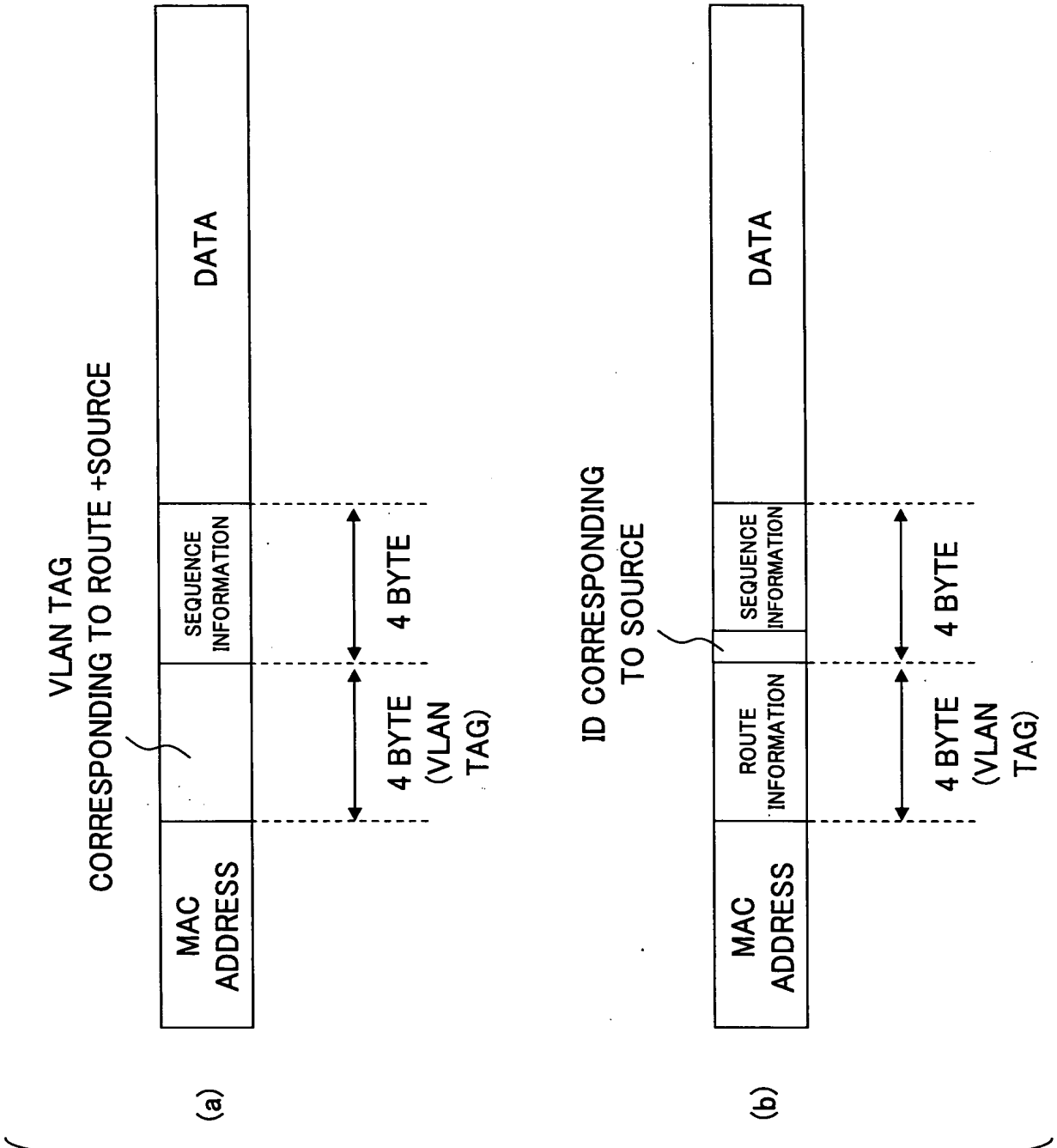

VLAN TAG
CORRESPONDING TO ROUTE +SOURCE
MAC ADDRESS
SEQUENCE INFORMATION
DATA
4 BYTE
4 BYTE (VLAN TAG)
(a)
ID CORRESPONDING TO SOURCE
MAC ADDRESS
ROUTE INFORMATION
SEQUENCE INFORMATION
DATA
4 BYTE
4 BYTE (VLAN TAG)
(b)

FIG.51

FIG.52

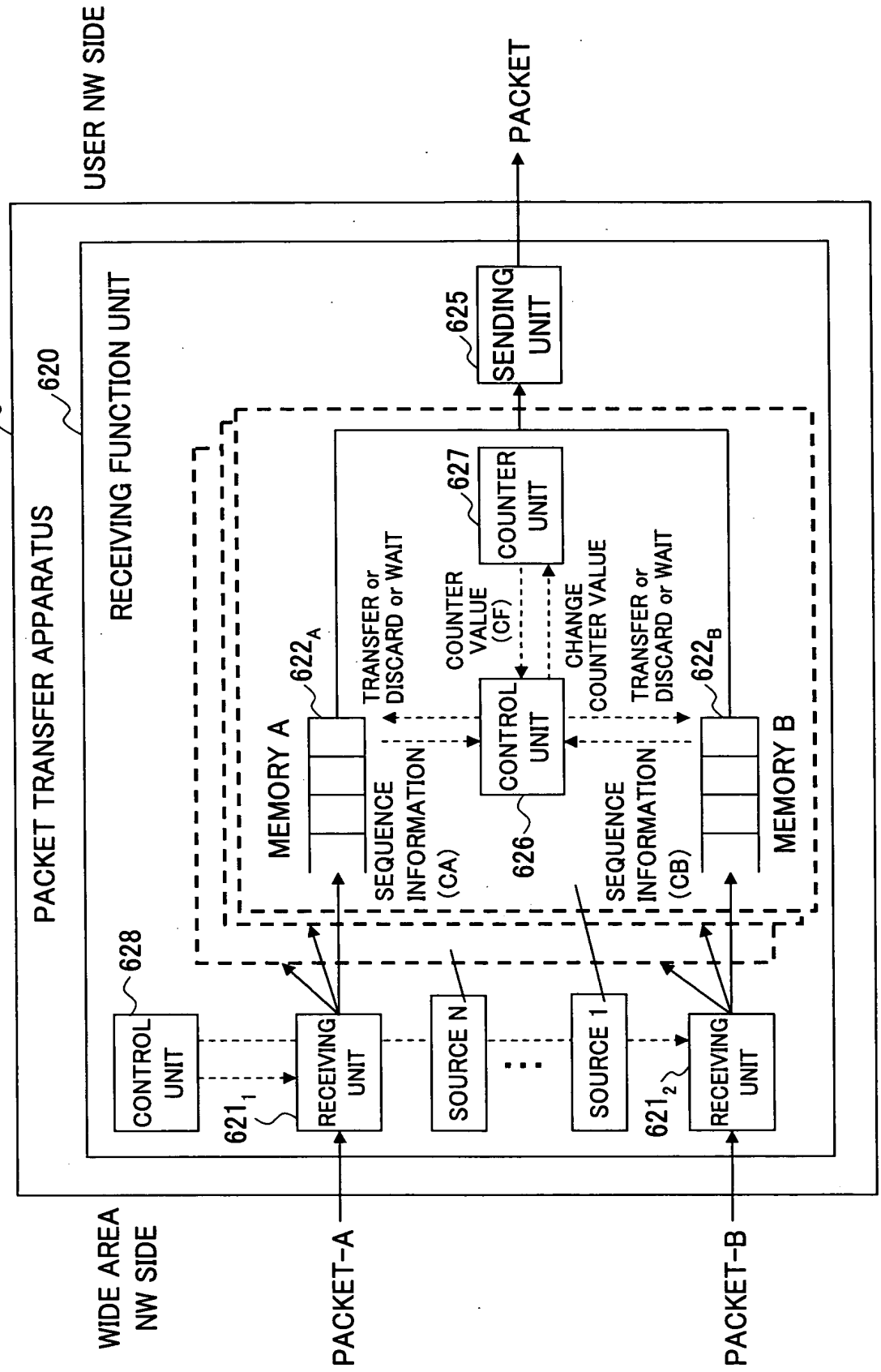

600
PACKET TRANSFER APPARATUS
620
RECEIVING FUNCTION UNIT
USER NW SIDE
PACKET
625
SENDING UNIT
627
COUNTER UNIT
COUNTER VALUE (CF)
CHANGE COUNTER VALUE
TRANSFER or DISCARD or WAIT
TRANSFER or DISCARD or WAIT
622A
622B
MEMORY A
MEMORY B
SEQUENCE INFORMATION (CA)
SEQUENCE INFORMATION (CB)
CONTROL UNIT
626
628
CONTROL UNIT
RECEIVING UNIT
621 1
SOURCE N
SOURCE 1
621 2
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B

FIG.53

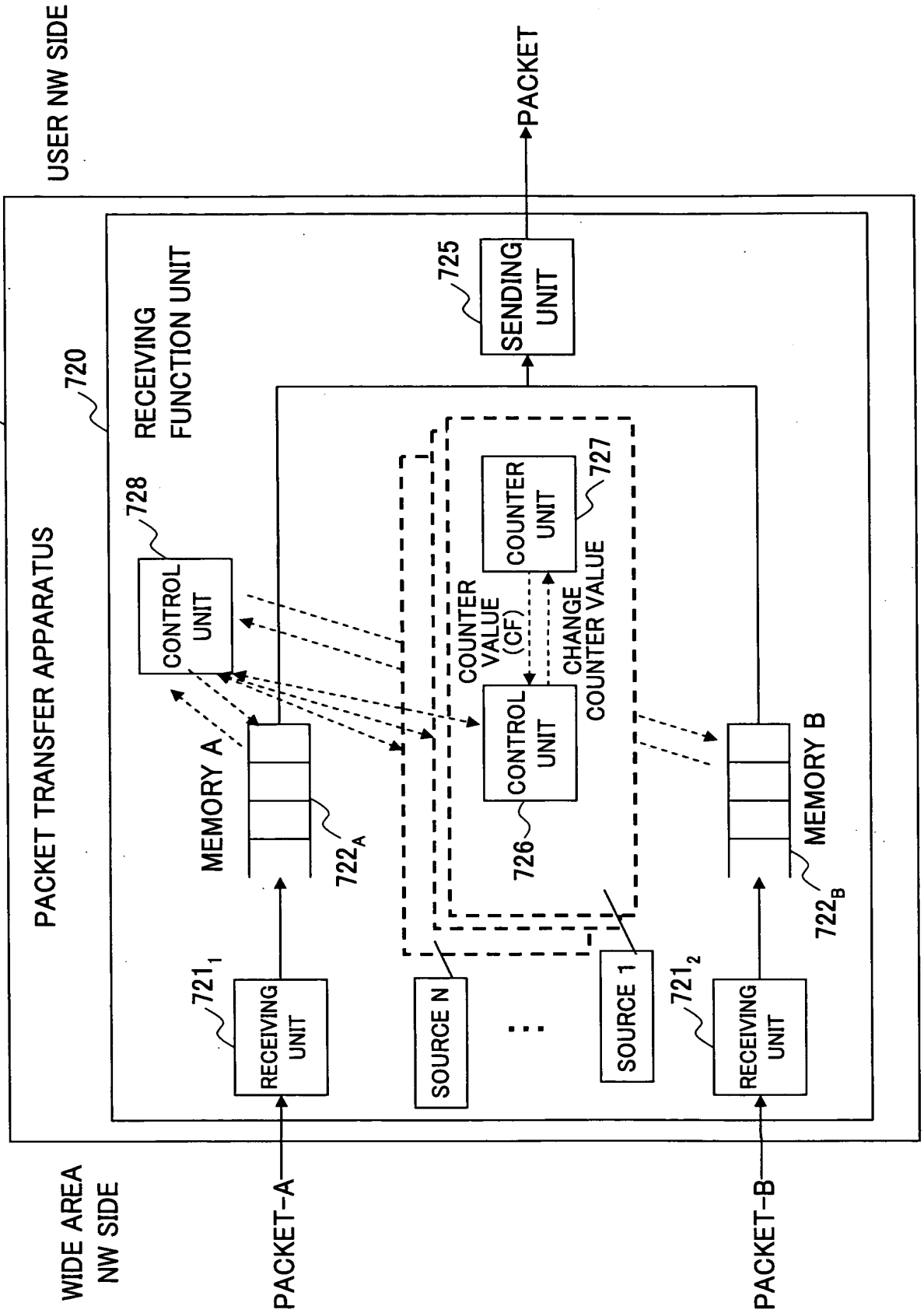

700
PACKET TRANSFER APPARATUS
720
RECEIVING FUNCTION UNIT
USER NW SIDE
PACKET
725
SENDING UNIT
728
CONTROL UNIT
COUNTER UNIT
727
COUNTER VALUE (CF)
CHANGE COUNTER VALUE
CONTROL UNIT
726
MEMORY A
722A
MEMORY B
722B
721 1
RECEIVING UNIT
SOURCE N
SOURCE 1
721 2
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B

FIG.54

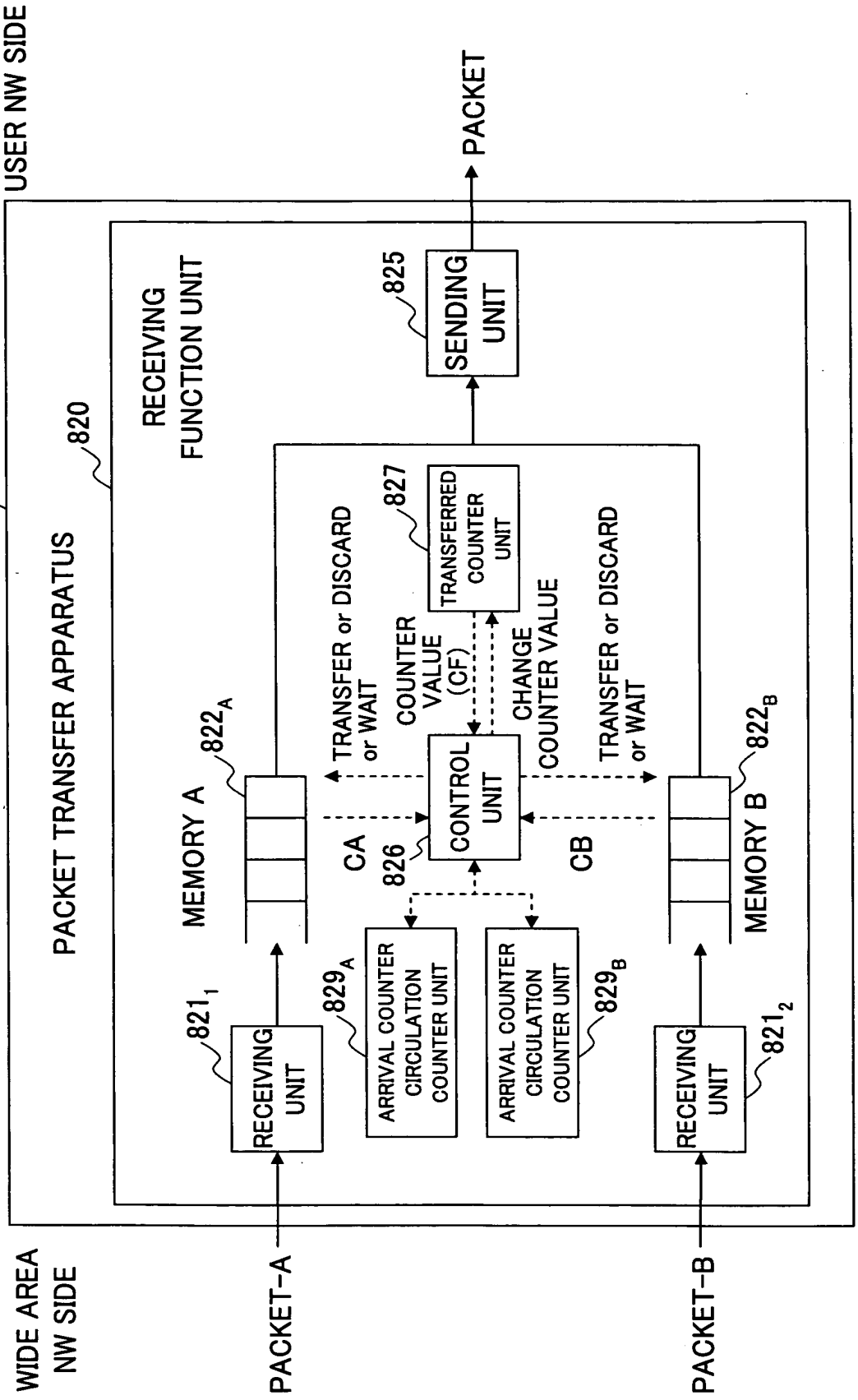
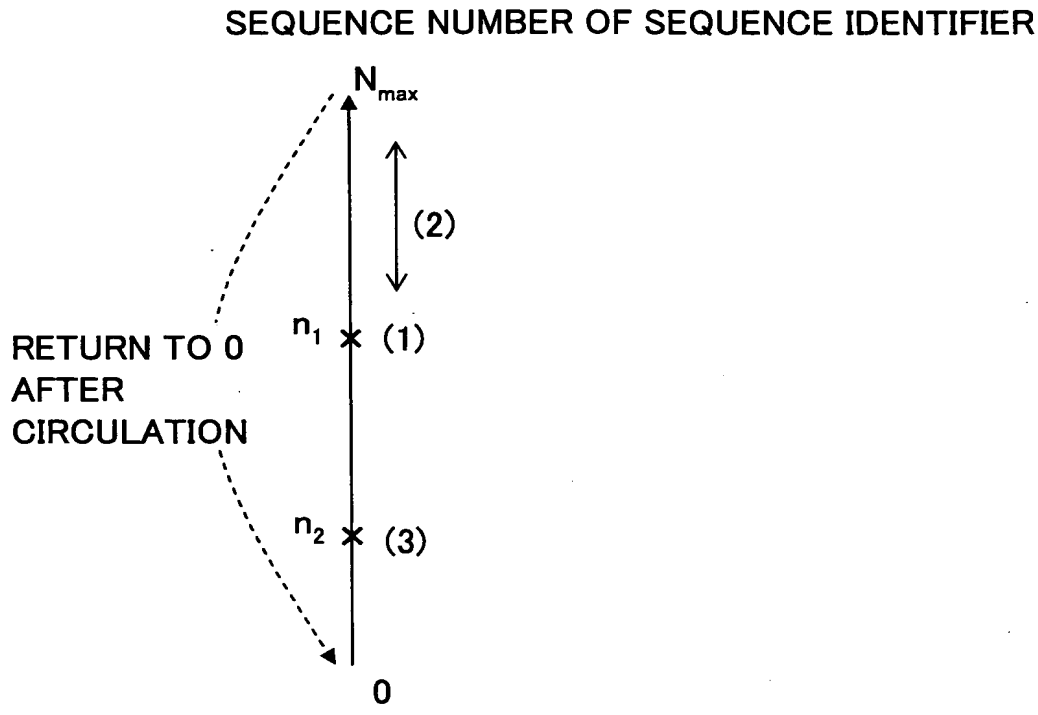
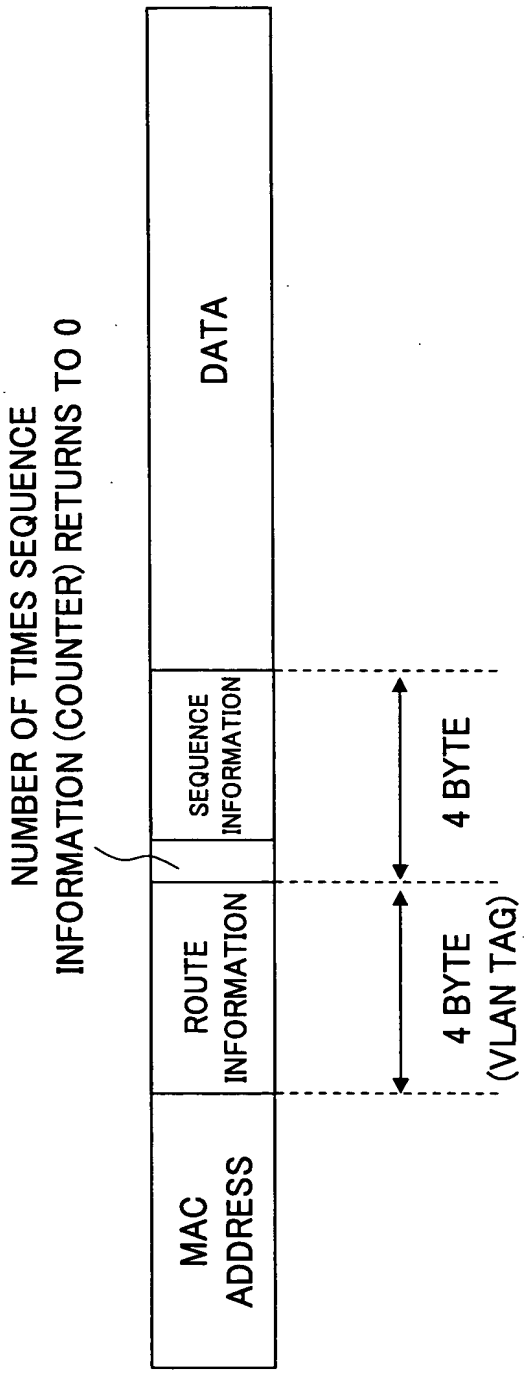

USER NW SIDE
PACKET
800
820
PACKET TRANSFER APPARATUS
RECEIVING FUNCTION UNIT
825
SENDING UNIT
827
TRANSFERRED COUNTER UNIT
TRANSFER or DISCARD or WAIT
COUNTER VALUE (CF)
CHANGE COUNTER VALUE
TRANSFER or DISCARD or WAIT
822A
MEMORY A
CONTROL UNIT
826
CA
CB
822B
MEMORY B
821 1
RECEIVING UNIT
829A
ARRIVAL COUNTER CIRCULATION COUNTER UNIT
829B
ARRIVAL COUNTER CIRCULATION COUNTER UNIT
821 2
RECEIVING UNIT
WIDE AREA NW SIDE
PACKET-A
PACKET-B

FIG.55



N_{max} IS THE MAXIMUM VALUE OF SEQUENCE NUMBER
(ex: WHEN SEQUENCE IDENTIFIER IS x BIT, $N_{max}=2^x$)

FIG.56


NUMBER OF TIMES SEQUENCE INFORMATION (COUNTER) RETURNS TO 0
MAC ADDRESS
ROUTE INFORMATION
SEQUENCE INFORMATION
DATA
4 BYTE (VLAN TAG)
4 BYTE